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INDIAN FARMING

ISSUED BY
THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH

सत्यमेव जयते

Vol. XI : No. 1
JANUARY 1950

Subscription : Rs. 6 per annum : 8 as. or 9d. per copy

PUBLISHED BY THE MANAGER OF PUBLICATIONS, DELHI
PRINTED AT THE JOB PRESS LTD., KANPUR.

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ISSUED BY
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Vol. XI : No. 2
FEBRUARY 1950

Subscription : Rs. 6 per annum : 8 as. or 9d. per copy

PUBLISHED BY THE MANAGER OF PUBLICATIONS, DELHI
PRINTED AT THE JOB PRESS LTD., KANPUR.

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ISSUED BY
THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH

सत्यमेव जयते

Vol. XI : No. 3
MARCH 1950

Subscription : Rs. 6 per annum : 8 as. or 9d. per copy

PUBLISHED BY THE MANAGER OF PUBLICATIONS, DELHI
PRINTED AT THE JOB PRESS LTD., KANPUR.

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INDIAN FARMING

ISSUED BY
THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH

सत्यमेव जयते

Vol. XI : No. 4
APRIL 1950

Subscription : Rs. 6 per annum : 8 as. or 9d. per copy

PUBLISHED BY THE MANAGER OF PUBLICATIONS, DELHI
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INDIAN FARMING

ISSUED BY
THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH

सत्यमेव जयते

Vol. XI : No. 6
JUNE 1950

Subscription : Rs. 6 per annum : 8 as. or 9d. per copy

PUBLISHED BY THE MANAGER OF PUBLICATIONS, DELHI
PRINTED AT THE JOB PRESS LTD., KANPUR.

ICAR—21.6.50
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Dr H. R. Tolley, Director of Economics and Statistics Division of FAO addressing the inaugural meeting of the International Training Centre on Census and Statistics. The Centre was inaugurated by the hon. Shri Jairamdas Daulatram, at New Delhi on 1 November, 1949. Seated at the right of the hon. Minister is Shri S. M. Srivastava, Joint Vice-Chairman of the I.C.A.R. Others from left to right are Dr P. V. Sukhatme, Mr. C. P. G. J. Smith of the Netherlands Statistics Office, Prof. P. C. Mahalanobis, Shri C. K. Dilwali, and Shri T. S. Krishnamurti, Secretary of the I.C.A.R.

PLATE 1

INDIAN FARMING

JANUARY, 1950

Vol. XI No. 1

INTERNATIONAL TRAINING CENTRE ON CENSUSES AND STATISTICS*

IT gives me great pleasure to be able to welcome you all as representatives of our sister countries of South Asia to a big task which in outward proportions might at present seem a small one. It is due to the interest which the FAO and UNO and the ECAFE have been taking in seeing that the economy of the world progresses on some planned basis that we in this country have had the opportunity of welcoming you here in our midst. It has been the good fortune of some country or other on different occasions to receive international delegates. I believe the more often we have these occasions for international gatherings, the greater will be the benefit which man as man will derive. It is on these occasions that national barriers are broken ; we cease to feel that we represent only a small little bit of the world ; we cease to regard ourselves as very different from other fellow beings in the rest of the world. It is on these occasions that we experience the feeling that after all we are fellow human beings with common problems and common aspirations. It is in that light that I look upon this nucleus gathering of delegates from the South East Asian countries. They will be our guests for the next three months. They will be working together, planning together and, I hope, living together. And, I wish that as they work and plan together, they will realize that the purpose for which they have come to India is not simply to receive training in any particular science, but that the objective of their visit and training is the service of the common man, irrespective of colour, creed or nationality. The world is moving fairly rapidly towards that goal. National barriers are slowly breaking. More and more occasions arise when man must meet man as man and not as belonging to a particular nationality, creed or colour. Therefore, I hope that, while doing your daily tasks, you will realize that the objective for which you have come to India, is to plan for the benefit of the common man.

No plan for the benefit of the common man is possible unless we have a clear picture of his surroundings, his environment and of the manner in which these surroundings and the environment have worked prejudicially to the interest of the common man. Let me take a simple illustration. For ages together men have been born and have suffered and died. Men have suffered without a proper study as to why they have suffered and from what they have suffered ; to what disease they have fallen victim and whether death could not have been prevented Gradually we awoke to the need of a proper health survey of the common man. Gradually was mobilized the science of statistics, which tries to study what diseases prevail in a country, areas where they have been prominent and the ages in which their attack is most common. Take the case of that fell disease tuberculosis. A survey of different parts of a country is necessary to find out in which areas tuberculosis is more common than elsewhere, at what age tuberculosis attacks man most and what are the more common factors which lead to the spread of the disease. With the aid of a proper statistical survey, we try to find solutions to defend man more effectively against this enemy. Similarly

* Inaugural Address delivered by the hon. Shri Jairamdas Daulatram, Minister for Food and Agriculture, Government of India, on 1 November, 1949, at the opening ceremony of International Training Centre on Censuses and Statistics in New Delhi.

every other part of our environment, which affects man prejudicially, has to be studied with the aid of statistics. Statistics give us a clear and definite picture. We may have vague notions, for instance, of the prevalence and spread of diseases but unless we have a detailed and clear picture of the problem, it is not possible to arrive at a proper solution. It is necessary, therefore, to examine these surroundings of man and his environment in a concrete manner.

It is possible for man to take up a passive attitude and allow his surroundings and his environment to continue to affect him prejudicially as has happened in many cases in the long past, but man has now ceased to adopt such an attitude. He wishes to deal with his environment dynamically. He wants to study his environment and discover in what manner it is harmful and how it hinders progress, and he tries to change the environment, change the factors which prejudice his progress, change the causes which are harming him. It is only when we take up that dynamic attitude towards our environment that we feel the necessity of having a full and detailed picture of it.

In this country, we have a tradition of fairly reliable statistical surveys in the long past but of a very limited nature. Four centuries before the Christian era, an official publication in our ancient Sanskrit language laid down the details of census operations. Under the great Mauryan kings of Bihar specific provisions were made for carrying out a census. Those census operations, however, did not cover a large field of human activity. It was a limited and restricted census meant for a definite objective. But in modern times we want progress not only in the social or political field but even more in the economic field. It is vital that our censuses are more complete and detailed. It is from that point of view that the FAO, UNO and ECAFE have come to realize that if we have to progress towards prosperity, we must plan correctly. And, if we have to plan correctly, we must know our surroundings and environment accurately.

I hope that all of you who have gathered together from various countries of South East Asia will have this common objective and that, as you study and work together, you will bridge your narrow national gulfs and, for the service of the common man, try to get the utmost benefit out of your three months' stay with us. I know that you cannot represent your Governments completely. After all, you are specialists sent out here to pick up all you can from the pool of common knowledge and experience, and have to carry out your duties in a restricted sphere in your own country. But when you go back to your country, I would urge upon you to see that unless the science of statistics is given the place which it deserves, it would be impossible to serve the common man in the coming times. For, we are then bound to plan in darkness. We will be moving on a path on which there is no light. And since we will be working in the dark, working without light, we are likely to make many a mistake in our planning for our countries. We all spend a great deal on the security and defence of our countries. We should spend as much on internal peace and prosperity. All this implies that we should create factors which help us to plan accurately. Therefore, I hope that when you go back, you will go back with a determination to help your country to give statistics their rightful place. At the end of your three months' stay, having, as I said, worked and lived together, when you go back to your work, you should leave with the feeling that you are not working only for your own country, that you are not working only for the common man of your country, but that you are working for the common man of the world. Go back with the feeling that in the coming times, the greatest problem before us is to solve the problems of the common man and to shape political and economic policies for his abiding welfare. I have no doubt that if you return with that sentiment and are able to influence the decisions and policies of your country, you will have contributed your mite towards a great ideal. International gatherings are held not to strengthen blocks for the purpose of war. I hope that at gatherings like this, we will create forces which ultimately will lead to more and more international collaboration for the purpose of planning for peace and progress of the common man.

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10/24

S. M. SRIVASTAVA

AN OBITUARY

WE are sorry to record the sad and untimely death on Sunday, 4 December, 1949, of Mr. S. M. Srivastava. At the time of his death Mr. Srivastava was Joint Vice-Chairman of the Indian Council of Agricultural Research and *ex officio* Joint Secretary to the Ministry of Agriculture, Government of India. Mr. Srivastava was apparently quite well, and only a few days before his death, he attended one of the sessions of the Advisory Board of the Council, and no one ever suspected that his end was so near. He leaves behind several children and his wife, Mrs. R. Srivastava, daughter of Dr Panna Lal who retired some time ago from the Indian Civil Service as Adviser to the Governor of the United Provinces.

Mr. Srivastava was born on 13 July, 1910, and had a brilliant academic career at the University of Allahabad from which he graduated and also, in due time, took a post-graduate degree in zoology. He was also for some time at Jesus College, Oxford. While in England he successfully competed for the Indian Civil Service. Returning to India in November, 1934, he was posted to the cadre of the Service in the United Provinces where he served till May, 1943, when his services were placed at the disposal of the Government of India. He was appointed Secretary to the Indian (then Imperial) Council of Agricultural Research in February, 1944, and, later on in February, 1945, Deputy Secretary to the Government of India in the then Department of Education, Health and Lands. With the creation of a separate Department of Agriculture, he was posted to that Department as Deputy Secretary in September, 1945. He returned to the Indian Council of Agricultural Research a second time as Secretary in October, 1947, and in May, 1949, he was made Joint Vice-Chairman of the Council ; as Joint Vice-Chairman he was also *ex officio* Joint Secretary to the Ministry of Agriculture. It would thus be seen that he was connected with the administration of the Department or Ministry of Agriculture for

a number of years. In this work his scientific training, especially in one of the branches of natural history closely connected with agriculture and animal husbandry, stood him in good stead. His success in a large measure may be due to his genuine grasp on the subjects he was required to handle.

Young in years though he was, Mr. Srivastava rose to a high position by sheer dint of merit and hard work. Medium in height and rather thinly built, he was an altogether amiable person ; his face bore an imprint of calm serenity and otherworldliness which is rarely to be found in men engrossed with too many cares of a high official position. It is needless to mention that he was very popular with all who came in contact with him. Sympathetic as was his nature, he did not allow a rigid stiff-necked attitude to interfere with his dealings with persons placed under his care. Nor was his vision blurred by secretariat routine and procedure. Inevitably, therefore, his approach to life and its problems was not in any way sectional or circumscribed. It is because of these qualities that he could make numerous friends and admirers. The Service is indeed poorer by the passing away of such a man as he, especially at a time when the country stands in dire need of experienced officers. (U.N.C.)

S. M. SRIVASTAVA
13 July, 1910 4 December, 1949

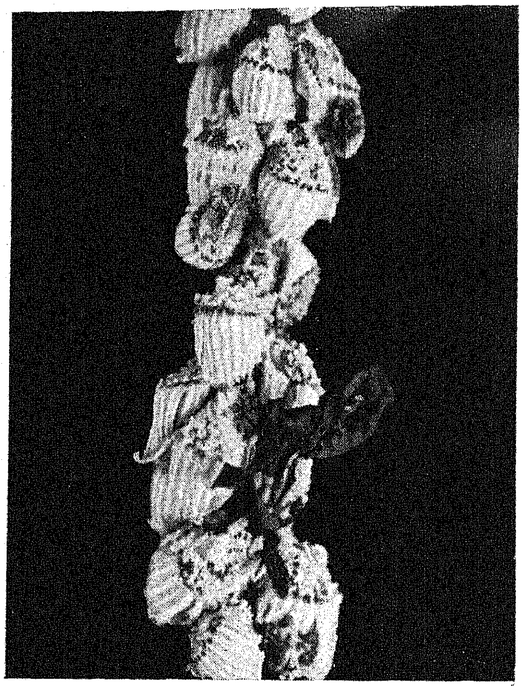


FIG. 1. A *Plumbago* twig with a severe infestation of the Fluted scale.

FIG. 2. Enlarged view of the Fluted scale. Note the six *Rodolia* eggs on its egg sac.

FIG. 3. *Rodolia* grubs feeding on the pest.

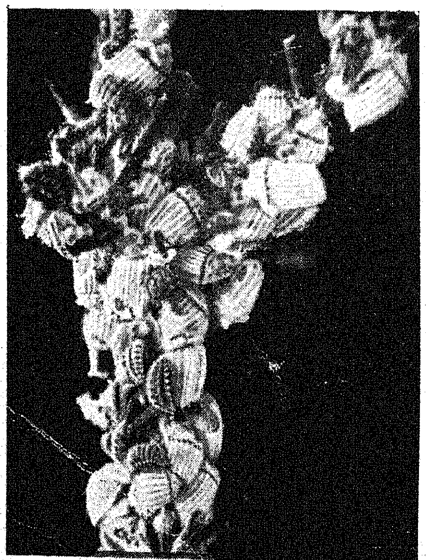


FIG. 4. A large number of *Rodolia* beetles feeding on the eggs of the pest.

A FOREIGN INSECT MENACE TO INDIAN CITRUS INDUSTRY CHECKED

By HEM SINGH PRUTHI

IN the early days of agricultural development in various countries, plants and plant products were brought into or sent out with little or no care concerning the insect pests or plant diseases which might be transported along with them. Several dangerous pests have thus spread from their native home to other countries. Moreover, it has often been found that when an insect is introduced into a new country, it breeds and spreads quickly and proves to be more destructive because of the absence of its natural enemies which were keeping it in check in its native home. One of such notorious insects is the Fluted scale also known as the Cottony cushion scale. This insect is a native of Australia where it is kept in check by its insect enemies, a beetle (*Rodolia cardinalis*) and a small fly (*Cryptochaetum iceryae*) which feed on it. When the Fluted scale entered into California, it almost destroyed the citrus industry. It could only be brought under check after the introduction of its natural enemies from Australia.

The pest in India

Similarly, the Fluted scale entered into India probably along with the Australian wattles which were imported in large quantities about the end of 19th century in Madras Province. It was first reported as a serious pest in 1928 on the Nilgiri Hills. The Madras Government immediately introduced its natural enemies from Australia and the pest was apparently brought under check by 1930-31, when the control work was discontinued. Unfortunately, no watch was kept on its activities and, in 1941, it was found again to have assumed a serious form both in the Nilgiris and Pulneys (Kodaikanal). Intensive surveys instituted by the Indian Council of Agricultural Research, under the direction of the writer, showed that the pest had not only spread on the hills named above but also in parts of Madras plains, on the hills of Travancore and all over Mysore State. It was also detected in a few localities in Coorg and at Poona in Bombay Province.

The female is easily recognized by the conspicuous white fluted egg sac attached to its hinder region. The pest breeds and multiplies rapidly. Each female lays 400 to 1,000 eggs and there are three to four generations a year. Even if only 200 young ones survive from a single mother, its progeny in a year would be 1,600,000,000. This enables the pest to establish itself and spread very rapidly. The females can reproduce without even mating with the male.

The Fluted scale is capable of feeding on innumerable hosts and in India it has already been found attacking over 100 different plants of which many are of considerable economic importance, e.g. orange, lemon, wattles, apple, pear, eucalyptus, casuarina, etc. Thousands of scales quickly cover the host plants and drain off the sap as a result of which the plants gradually die. The insect is also responsible for the black sooty mould which besides damaging the plants greatly reduces the market value of fruits such as citrus.

Controlling the pest

A Central Laboratory was established in 1946 at Bangalore under the control of the Plant Protection Adviser to the Government of India. As it is already well-known that

HEM SINGH PRUTHI, PH. D. & SC. D. (Cantab). F.R.A.S.B., F.N.I., is Plant Protection Adviser to the Government of India.

the pest can be more efficiently and economically controlled by using its insect enemies which feed on it than with chemical means, the *Rodolia* beetle, referred to above, which have kept the pest under check in Australia and California, were introduced into Peninsular India. These natural enemies, as well as a few indigenous beetles and a caterpillar (*Euzophera cocciphaga*), were mass multiplied in the Central Laboratory and distributed to the provinces and States concerned for liberation in all the different infested areas. This measure has resulted during the course of two or three years in practically eradicating the pest in the provinces of Coorg and Bombay and checked its spread in Mysore, Madras and Travancore. Judging from the rate at which the pest was spreading prior to the establishment of the Central Laboratory, it would have by this time easily reached the important citrus growing tracts of Bombay, Hyderabad and the Central Provinces. In 1945, it was a very serious pest of Casuarina trees in Bangalore, Kolar and several other districts of Mysore State, but now infestations of the pest are very rarely seen in this State. It is also now found in very small numbers mostly on wattles in the Kannan Devan Hills of Travancore. In Madras Province, however, it is still found on gorse—although on a small scale—in some localities of the Nilgiri Hills and on wattles in the Pulney Hills. Introduction of natural enemies and quarantine measures are therefore being continued in such areas till the pest is completely controlled. As sudden flare-ups of the pest are known to occur in other countries causing very serious injury to citrus and other valuable trees and enormous losses to orchardists, a close watch is also being kept on the pest to protect the citrus and deciduous fruit industry of the Indian Union.

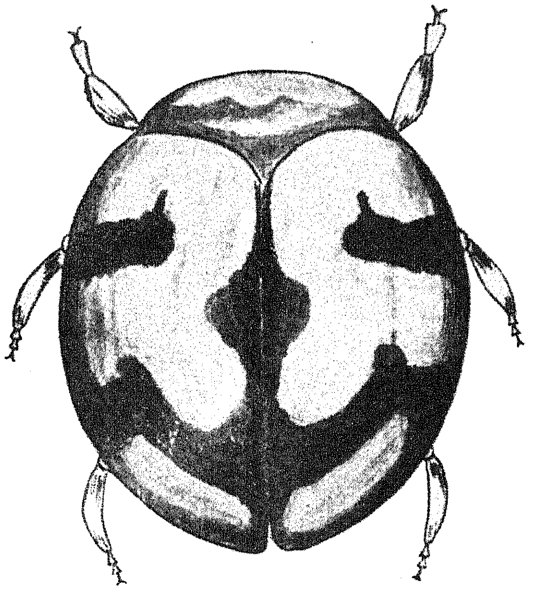


FIG. 5. Enlarged view of a *Rodolia* beetle.

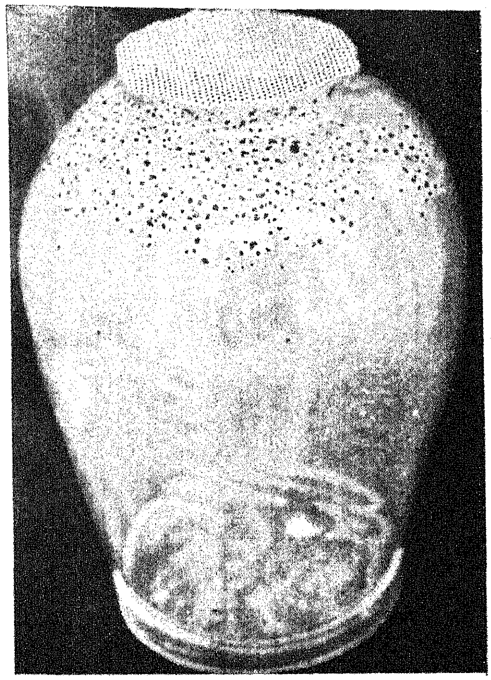


FIG. 6. (Top right). A view of a cage where *Rodolia* grubs pupate.

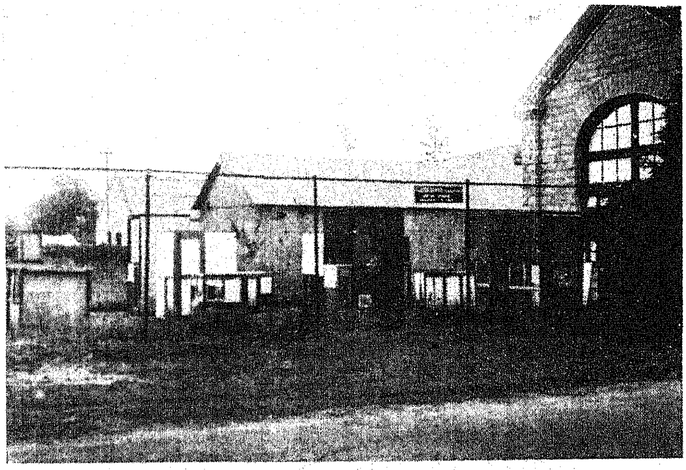


FIG. 7. A general view of the Fluted scale control laboratory. In these cages mass multiplication of the natural enemies of the Fluted scale is carried out.

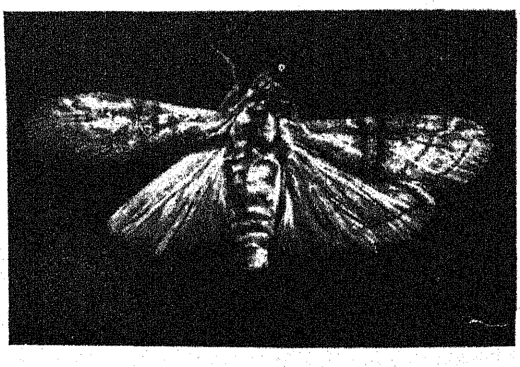


FIG. 8. The moth (*Euzophera cocciphaga*); its caterpillars feed on eggs of Fluted scale.

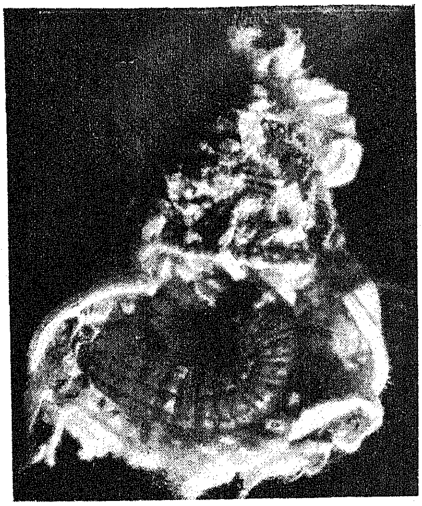


FIG. 9. An egg sac of the Fluted scale opened showing a *Euzophera* caterpillar inside feeding on eggs of the pest.

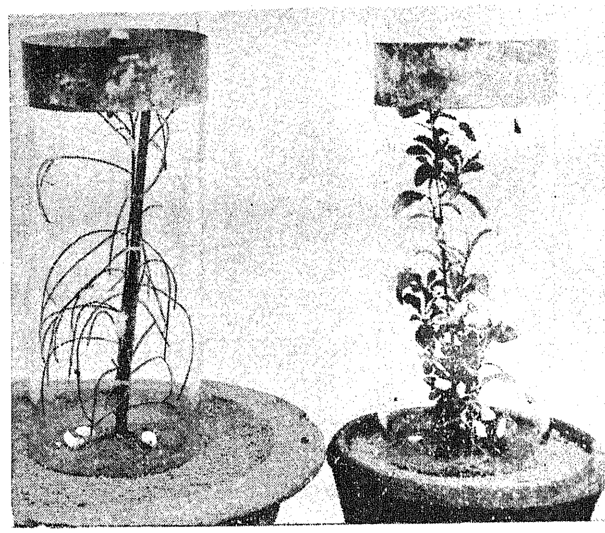


FIG. 10. Breeding cages for *Euzophera* moths in the laboratory.

FIG. 11. A large size cage for breeding *Rodolia* beetles. An entomologist is busy examining their breeding.

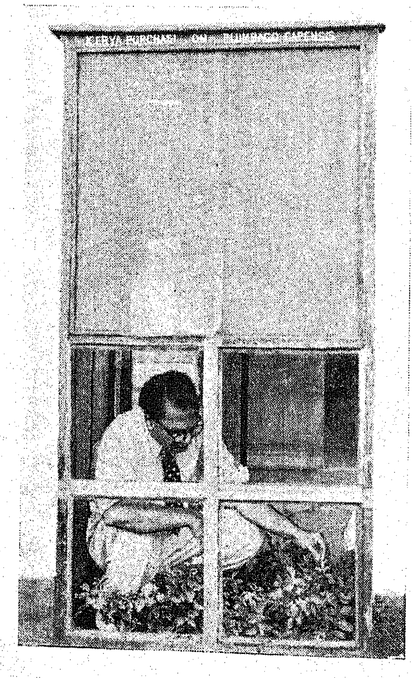
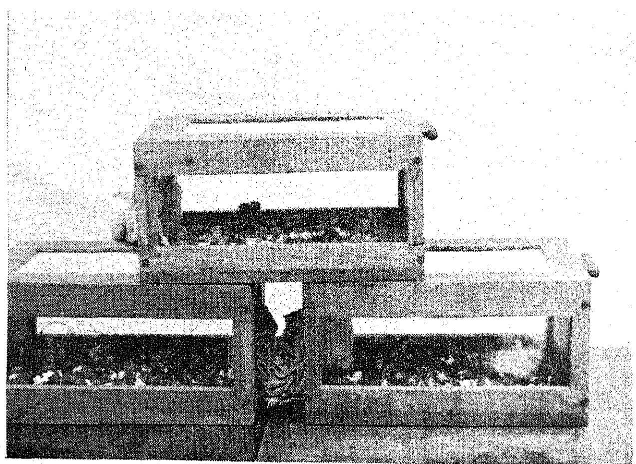


FIG. 12. Cages in which hundreds of *Rodolia* beetles and *Euzophera* caterpillars are reared for distribution to various provinces and States for liberation in areas infested by the Fluted scale.



HOW TVA WORKS FOR AGRICULTURAL DEVELOPMENT OF TENNESSEE VALLEY

By S. K. MUKERJEE

TENNESSEE VALLEY is an excellent example of how men can prove to be the worst soil miners with saws and ploughs—upsetting the natural equilibrium of soil vegetation and climate. Nature had clothed the hillside of the Valley with forests and wild grasses, where raindrops could not beat hard and wash away the fertile topsoil. Pioneers made fortunes by thoughtless lumbering of forests, paying little attention to selective cutting, replacement or fire prevention. Then followed the ruinous practice of growing tilled cash crops like cotton, maize or tobacco on the countryside and dangerous reliance was placed on one-crop farming which left the land exposed to the severity of rains during winter. These practices of the pioneers and their descendents led to severe soil erosion, unprecedented floods in the river and depletion of fertility with the removal of topsoil—the life blood of vegetation. As a result, in less than a century of felling the first tree, much harm was done to the people in the Valley. In the autumn of 1933, it was reported in some countries of the southern highlands of the Valley, that more than 50 per cent families were on relief. This state of affairs existed just after the last depression, when TVA was formed and entrusted with the work of carrying out a broad mandate for economic and social well-being of people living in the basin. Naturally, their first thought turned towards agricultural development of the Valley on scientific lines, to prevent erosion and restore life into the depleted soil. TVA themselves were vitally interested in reducing soil erosion lest their reservoirs behind the dams should fill up and cancel their six billion dollar (200 crores of rupees) investments before these had fulfilled the purpose for which these were constructed, viz. flood control, navigation benefits and electric power.

S. K. MUKERJEE, B.SC. (Agri.), Dip. Agri. (New Zealand), M.SC. (Iowa), is Assistant Director of Agriculture, Bihar.

Problems

The problem of stopping 'run-away acres' had to be solved by preventing the practices which interfered with nature's hydrologic cycle. It was not merely a problem of adopting a few conservation practices of terracing, contouring, strip-cropping, tree-planting, and sowing a few grass-clover-mixtures, etc. but also of maintaining one or two cows where only a few acres of cotton or maize grew. High rainfall had depleted the potential fertility in all moderate to steeply-sloped areas. Due to loss of mineral nutrients, even in pasture areas, erosion was rampant—unhampered by poor growth of vegetation. The control of erosion, rebuilding of fertility through re-adjusted cropping systems and meeting mineral deficiency by the use of fertilizers, were the three outstanding problems in the reorganization of agriculture in the Valley.

Organization of developmental work

TVA had been authorized by the U.S. Congress to work out any suitable plan for agricultural development. They sought the cooperation of the existing organization of agricultural extension service of the seven States, covered by the Valley, to assist them in transmitting to the farmer for adoption the results of research. The principal contribution of TVA consisted in providing funds for employment of more extension staff for intensive work, manufacture and supply of free phosphatic fertilizers, supply of electric power, researches into processing of agricultural products, etc. The extension service is administered by the Agricultural College of the State. Hence colleges, with their

staff better acquainted with the local conditions of farming, farmer's ability, soil and climate, were confidently able to suggest improvements in every step of agricultural production, leading towards the goal of soil conservation with better farm management.

The best way to demonstrate to the farmers the improved methods of farming was by tackling the farm as a unit rather than as scattered plots. After a few years, that farm would serve as a model for the farmers all round. The first condition to enlist the cooperation of the farmer was that he must own the land, so that he might be more interested in any permanent improvement made therein. In the joint administration of the Farm Unit Demonstration programme of the College and TVA, the respective obligations can be well-illustrated by excerpts from the contract signed between North Carolina State Agricultural College and TVA.

Respective obligations

'N. C. State College will (a) make available the personnel and incidental facilities of the Agricultural Extension Service, including the administrative organization, subject-matter specialists, supervisors and country agricultural agents ; (b) provide additional personnel and facilities to the extent required for efficient and economic administration of terms thereof ; (c) assist farmers in forming associations in each well-defined community as a vehicle for the expression of local initiative in preparing readjusted farm plans, selecting demonstration farms, recording results and diffusing information in respect thereto ; (d) assist such local organizations in selecting farms for demonstration purposes and in compiling, interpreting and applying results ; and, (e) through the Agricultural Extension Service approve all farm demonstration programmes and requisitions for fertilizers produced by the TVA, as required for the effectuation of farm plans.

'The TVA will, within the allocation for such purposes, provide funds to the College for the employment by the Agricultural Extension Service of the required additional members of the extension staff, and for the provision of additional facilities ; (b) provide fertilizer materials (initially, new phosphate materials) required in approved farm demonstration programmes ; and, (c) provide the necessary staff within its own organization to collaborate with the extension staff in the formulation, approval and execution of these demonstration programmes'.

Role of the test demonstration farmer and his farm

The test demonstration farm is a representative farm of a community, representative from the point of view of size, soil conditions, type of farming and economic status of the farmers. The selection of the farm is made with the help of the farmers' community committee, county organization, and county agent. These organizations assist in planning the demonstration and solving mechanical and financial problems, handling and distribution of fertilizers and other problems, like co-operative marketing. The farmer owning the demonstration unit farm has to sign a simple agreement with the extension service and the TVA which in brief runs as follows :

'To conserve the soil and water on my farm as an example to my community, I must set up a new programme of plant food supply.

I agree to

'1. Use the fertilizers supplied to me in no instance on row crops, but only on crops that hold and bind land-legumes and grasses.

'2. Leave plots for yield comparisons and to keep a record of costs and returns.

'3. Secure and use the recommended amount of lime.

'4. Work towards a system of terracing, crop rotation and permanent vegetative cover, including woodland, to control soil and water losses.

'5. Purchase or produce the seeds of crops that will cover the soil.

'6. Invite my neighbours to study the operations on my farm and to hold such field meetings as the extension service wishes'.

How they work test demonstration farm

First, the extension service people draw up a map of the farm, and in consultation with the farmer, a cropping scheme is laid out for each field keeping in view the type of soil and slope. They lay emphasis on pasture crops, winter cover and reduction of inter-cultivated crops. The latter are recommended on more level land. Voluntary legumes

come up usually as the fertility of the land is improved by the application of fertilizers, but an initial seeding of clover is preferable. The livestock enterprise is gradually adjusted to this change from the practice of growing tilled crops to more diversified mixed farming. Allied to these soil and crop adjustments are the adoption of contouring, strip-cropping, terracing and afforestation of very steep slopes. Disposal of crops grown follows next. As more importance is attached to pasture crops, the livestock industry becomes more prominent. In the renovated pastures not only is the yield of forage larger but the feeding value is also improved which shows up in the productive efficiency of the animals.

In brief the extension service furnishes the technical guidance and the TVA provides fertilizers, free of cost. The selected farmer takes all the risk in land, labour, capital, seed, equipment, and other supplies needed to carry out the plan of operation for about ten years. Thus no spoon feeding is done by Government agencies to prove the efficiency of research developments. There are over one thousand such farms in the Valley. The next step is the watershed or area for farm demonstration. This is set up in a community where one or more unit demonstrations have shown the possibilities of wide adoption of improved methods of farming, and other farmers as a group, wish to adopt this system. Usually, such a group consists of a community in a small watershed area An inventory of the resources is made and the problems are tackled on an area-basis where all the farmers cooperate for mutual betterment. The same conditions of fertilizer supply and technical guidance, as in the case of unit farm, apply. As such projects gain in momentum, other community benefits follow in natural sequence.

Some demonstration farms

The writer visited such a farm in Jefferson county, Tenn. The farm was of 40 acres of which 30 acres consisted of steep slopes. But 15 years ago all that land grew cotton. At the time of its selection, they had to use bulldozers to fill up some of the gullies to enable farm machines to pass. Now all those gullies had been filled up. Except one acre of tobacco on level land, the rest was improved pastures or winter legumes. The owners' 20 milking cows and an acre of tobacco provided him with enough income to enable him to build a new home and enjoy all the amenities of modern life. He said, 'We used to preach a religion of hell, fire and brimstone around the hills, and now we are preaching the gospel of green grass and fertilizers'.

The author met some farmers who were displaced when the reservoirs were built. They were farming on rich alluvial soil of the bottom lands. They could not be given the same type of land in exchange, nor could money buy such land in the Tennessee hills. They had to learn the hard way to farm the uplands using rotation and fertilizers and keeping the sod intact on the steep slopes. From grain farmers they had turned animal husbandry men. However, all of them agreed that in making peace with nature they were earning three to four times as much as they did in their former bottom-land farms.

Some achievements

Reduction in acreage of crops like cotton or maize did not materially reduce the total tonnage due to higher productive capacity of land, enriched with fertilizers. The change-over to diversified farming was coming slowly with education, but it seemed positive that 'TVA provided the psychological spark which hastened enormously the trend from cotton to cows'. Milk production in the Valley has increased by about 50 per cent since the inception of the TVA. The demonstration farms have increased their cash income by 300 to 400 per cent. Cheap electric power had led to greater industrialization and financial well-being of the farmers.

SOME IMPORTANT ECONOMIC PLANTS AND THEIR CULTIVATION

By JAI CHAND LUTHRA

IN *Indian Farming**, a note on New Economic Crops was published in 1942 giving information on some important plants used as drugs or for other economic purposes. Besides these plants there are many more which have medicinal properties and are used in allopathic as well as in Indian systems of medicine. In this article information is given regarding some more plants as supplement to the note already published. At present there is an acute shortage of drugs in India on account of their restricted import from abroad due to lack of transport and other facilities. To meet the pressing demand keen interest has been aroused to grow drug plants and information in this note is given for guidance of those who possess suitable land of the required climatic conditions and wish to undertake their cultivation.

1. *Apium graveolens* (Family: Umbelliferæ; Vern : *krafas, sulehry*)

It has been cultivated in Amritsar, Jullundur and Saharanpur for several years. There was a great demand for its seeds in America and Europe and this promoted its cultivation. The growers obtained good price for it. The plant is propagated from seed which is sown in nursery in September-October.

Seed at the rate of two seers per acre is sown in nursery. Seedlings when 4 in. high are transplanted at a distance of 1½ ft. in lines and 2 ft. apart either on flat or on ridges and irrigated immediately afterwards. It needs frequent irrigation so as to keep the soil moist. Occasional hoeing is done to keep down weeds.

The crop matures in April and is cut when the seeds are somewhat green but are ripe otherwise. The cut crop is stacked in the field for a few days and then thrashed for seed. The yield of seed is 6 to 8 maunds per acre. The seed contains an essential alkaloid which is of commercial value abroad.

* *Indian Farming* (1942), 3 (5), 277-280

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2. (*a*) *Artemisia maritima* (Family : Compositæ; Vern: *asfantin, kirmala*)

It is a perennial shrub with thick rootstock. Leaves are deeply cut and have strong smell. Flowers are yellow and appear in August-September.

It grows wild in abundance in hills at altitudes of 4,000 to 14,000 ft. in Kashmir, Lahoul, Baluchistan and Afghanistan. The flowers, buds and young shoots contain santonin which is an expensive drug and is used as an anthelmintic for expelling intestinal worms. There was a factory at Baramula (near Srinagar) for the manufacture of santonin. The plant can be cultivated in high hills above Katrain (Kulu) in the Indian Union.

(*b*) *Artemisia brevifolia* (Vern : *mureen*)

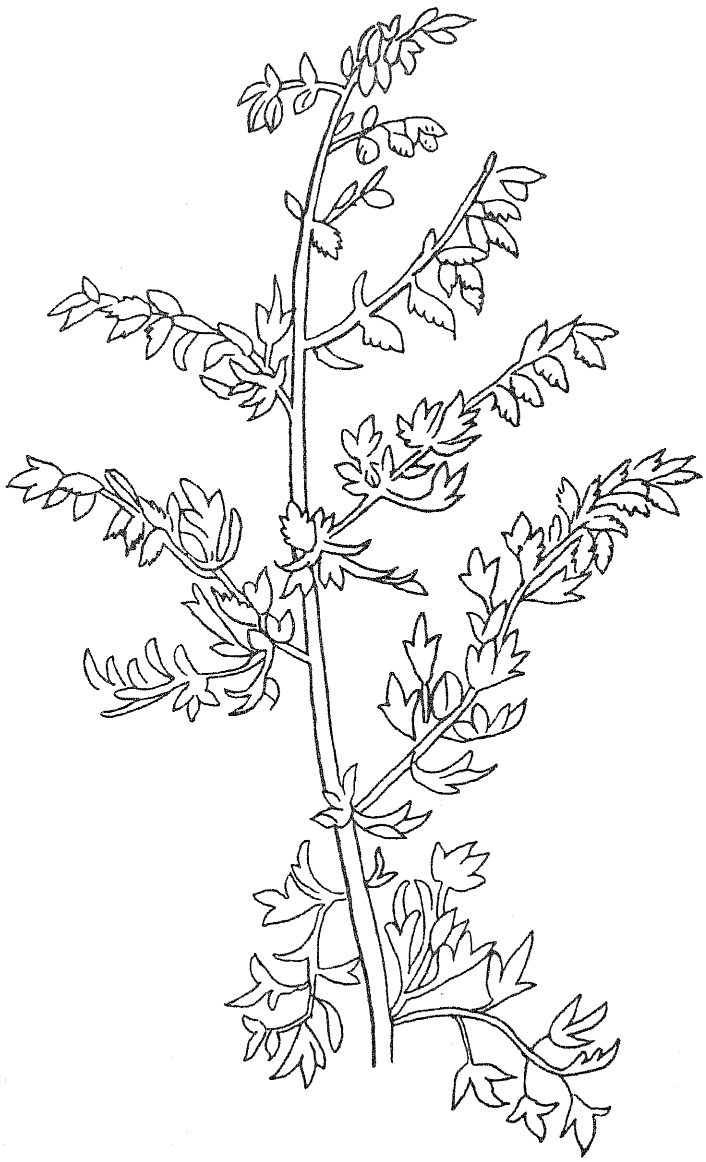
It is another species of similar characters and medicinal value.

(*c*) *Artemisia vulgaris*

It occurs at lower altitudes in Murree and in Kashmir Valley but is not as useful as the other two.

3. *Atropa belladonna* (Family: Solanaceæ; Eng: Belladonna, deadly nightshade; Vern: *suchi, Angur shafa*)

Belladonna is an erect perennial plant 4 to 5 ft. high. It can be cultivated at an altitude of 6,000 ft. or above. It is grown from seeds sown in nurseries in March-April at the rate of 2 to 3 lb. per acre. When the seedlings are 3 to 4 in. high they are transplanted in rows 4 ft. apart and 3 ft. between plants. The plant was cultivated successfully in the Punjab hills from seeds obtained from the U.S.A. Bureau of Plant Industry.



Artemisia maritima Linn. (Vern. *Afsantin*)

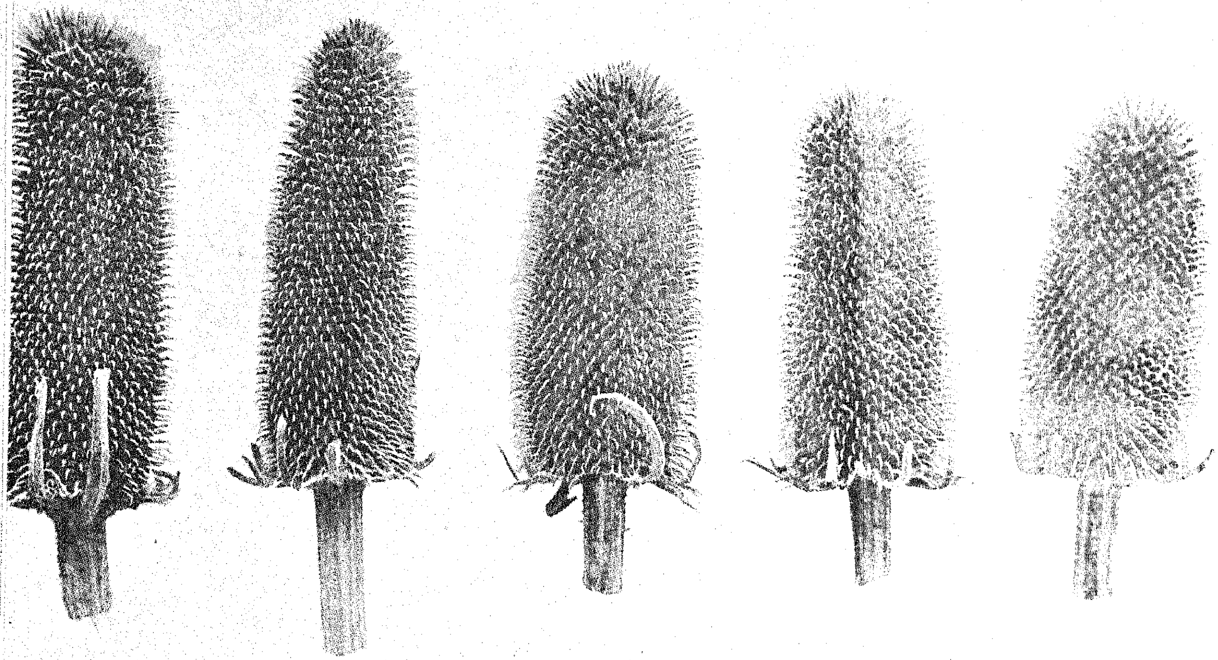
PLATE 6

Atropa belladonna Linn. (Vern. *Suchi*)

PLATE 7

Teasel plot: Palampur (Punjab), 1940.

PLATE 8



Heads of teasel grown in the Murree Hills (Punjab).

PLATE 9

A. acuminata occurs wild in Kashmir hills and its alkaloidal contents are up to B.P. standard.

Belladonna thrives best in rich well-drained loamy soil. The plant flowers from July to October, and the seeds ripen from September to November.

At the time of flowering leaves are plucked, dried in the shade and are stored when thoroughly dried. The roots are also used as medicine and are dug out when plants are three to four years old.

An average of 600 lb. per acre of dry leaves can be obtained under favourable conditions, while the yield of roots is from 150 to 200 lb. per acre. This is a very useful medicinal plant. Roots and leaves are used as drugs for making tinctures, liniments and several other preparations. The plant is the source of atropine used in eye diseases.

4. *Colchicum luteum* (Family: Liliaceae; Vern : *surinjan*)

The plant grows wild in the western temperate Himalayas and is met with in open pastures or outskirts of forests in Kashmir, Chamba and the adjoining Hazara hills in the North-West Frontier Province at altitudes varying from 4,000 to 7,000 ft. Colchicine, an important growth substance, is extracted from it. Its cultivation has not been tried anywhere in India so far. It is used in gout and rheumatism.

5. *Citrulus colocynthis* (Family: Cucurbitaceae; Eng : bitter gourd ; Vern: *tuma*)

The plant is a perennial trailing creeper. It resembles the water melon plant.

It is found plentifully on sandy waste areas in the Punjab, Uttar Pradesh, Madhya Bharat, etc.

It grows from seed and spreads very quickly. It is a very hardy and drought-resistant plant.

The fruit is used both in the allopathic and indigenous systems of medicine. It is a strong purgative. It is used in dropsy, dysentery and biliousness.

6. Derris (*Derris sp.*) (Family: Leguminosae; Eng : tuba root)

Several species of *Derris* occur wild in India in the Assam hills. *Derris elliptica* and *D. malacensis* contain the alkaloid, rotenone, which is a powerful insecticide. In the Punjab, cuttings of *Derris* were obtained from Ceylon some years ago and were planted at Lyallpur and Gurdaspur. The plants have to be protected from frost in winter.

The plant is a middle sized bush and grows well on light soil. It is propagated from cuttings. The rooted cuttings are transplanted, during the rainy weather, 3 ft. apart in rows 5 ft. distant. Roots are harvested when they are two years old.

In Ceylon the yield of dried roots is 2,000 lb. per acre. Its bark and root, however, are used as fish poison and for killing insects.

7. (*a*) *Digitalis purpurea* (Family : Scrophulariaceæ ; Eng : Foxglove)

The cultivation of the plant has been taken up for its drug in the Nilgiris, Darjeeling, Kashmir and the Punjab hills at elevations of 6,000 ft. or above.

The plant is raised from the seed. The seed being fine should be mixed with sand before sowing. Seed at the rate of 1/4 to 1/2 lb. per acre is sown in March-April in nursery beds or pots.

Seedlings when 2 to 3 in. high are transplanted on ridges 1½ ft. apart, in rows 2 ft. distant. The plant begins to flower in the second year towards the end of April. Leaves are plucked and dried when the plant is in full bloom. After drying thoroughly, the leaves are stored in a dark place in air-tight containers. This is an important medicinal plant of the British Pharmacopæia and is used for making tinctures administered in heart diseases.

Digitalis thrives in ordinary well-drained soil. Yields of 500 to 600 lb. of dry leaves per acre may be obtained.

(*b*) *Digitalis lanata*

This is more powerful than *D. purpurea* and is cultivated in the same way.

8. *Fullers' Teasel* (*Dipsacus fullonum*) (Family : Dipsaceæ ; Vern : *burash*)

The teasel plant is of great industrial importance. It produces cylindrical heads (2 to 4 in. long) which bear recurved spines

all over the surface. They are used in woollen factories in the finishing process or raising the fibre or floss (nap) of hosiery, blankets, and other woollen goods.

The plant was introduced in the Punjab for the first time in 1931. There is a great demand for teasels, but as their use is confined to the wool industry only, the total requirements of the country are not so large as to cultivate the plant extensively. It should be grown as a side line on a small scale.

It is a biennial plant and can be grown at altitudes of 3,000 to 5,000 ft. It is grown from seeds sown in nursery in March-April at the rate of 1 lb. per acre in small raised beds and transplanted when 3 to 4 in. high on well-manured loamy soil, with good drainage, at a distance of 2 ft. between plants and rows.

About 50,000 good heads (2 to 4 in. size) may be obtained from one acre.

9. *Glycyrrhiza glabra* (Family : Leguminosae ; Eng : liquorice ; Vern : *mulathi*)

Cultivation of liquorice was introduced in the Punjab plains several years ago. The plant grows wild to some extent in Baluchistan and the North-West Frontier Province. It is a perennial shrub and is about 6 ft. high. The roots of this plant yield the liquorice of commerce.

It is quickly propagated from root cuttings obtained from old plants. The plant thrives on light soil and needs no special attention after it has once established itself. Its cultivation is easy and costs little.

The root cuttings are planted in February-March at a distance of 2 ft., in rows 3 ft. apart, on the flat and irrigated immediately afterwards. Watering is given at intervals as required. It is fairly drought-resistant.

The plants are dug up for the roots when they are three years old. The yield of dry roots is 30 to 40 maunds per acre. Its cultivation has been found to be profitable on a small scale in the Punjab.

The roots are used as laxative, and also in cough and urinary diseases. The roots are very popular as medicine and are largely employed in cough syrups and lozenges.

10. *Hyoscyamus niger* and *H. muticus* (Family : Solanaceae ; Vern : *khurasani, ajwain*)

Hyoscyamus niger is cultivated at Lyallpur and Saharanpur for a long time as a winter crop. It is an annual erect herb 3 to 4 ft. high and is grown from seed sown in October at the rate of 3 to 4 lb. per acre by directly drilling seeds in lines 2 ft. apart. A nursery of seedlings may also be raised for planting.

The plant thrives best on rich loamy soil and requires frequent irrigation in early stages of its growth. Flowering starts in the beginning of January and the leaves are plucked when flowers appear. The stripped leaves are strung on a rope and dried in shade. It is necessary to retain the green colour of the leaves. After plucking of leaves is over, the seeds are allowed to ripen and are harvested in April.

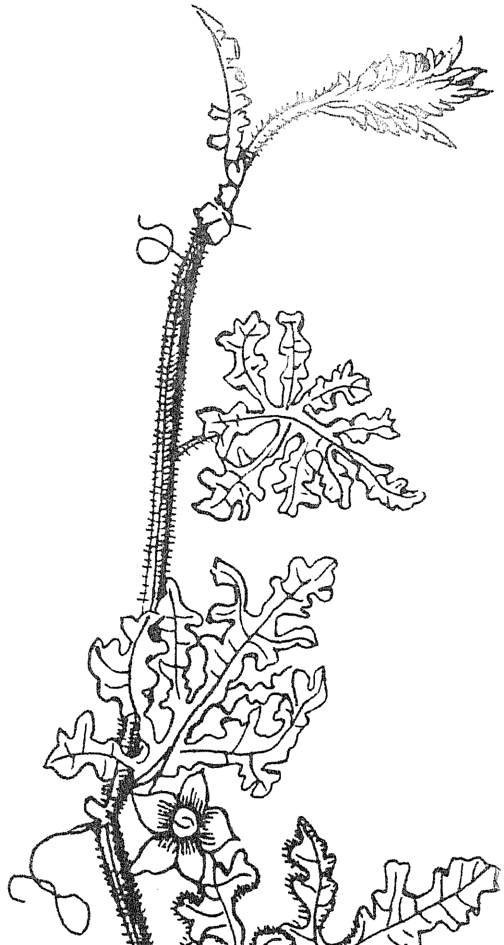
On an average five to six maunds of dry leaves can be obtained from one acre under favourable conditions and two to three maunds of seeds as well in addition to the leaves. This plant can be grown at altitudes of 3,000 to 5,000 ft. in April-May and harvested in October-November.

Another species, *H. muticus*, has been acclimatized and grown in Lyallpur in the Punjab. It requires exactly the same treatment. This is a perennial variety and lasts for several years. The leaves are thick and richer in alkaloidal contents. Samples of the plant grown at Lyallpur were found to be equal to the B.P. standard. Hyoscyamine, an important medicine, is extracted from the leaves ; it is used in asthma.

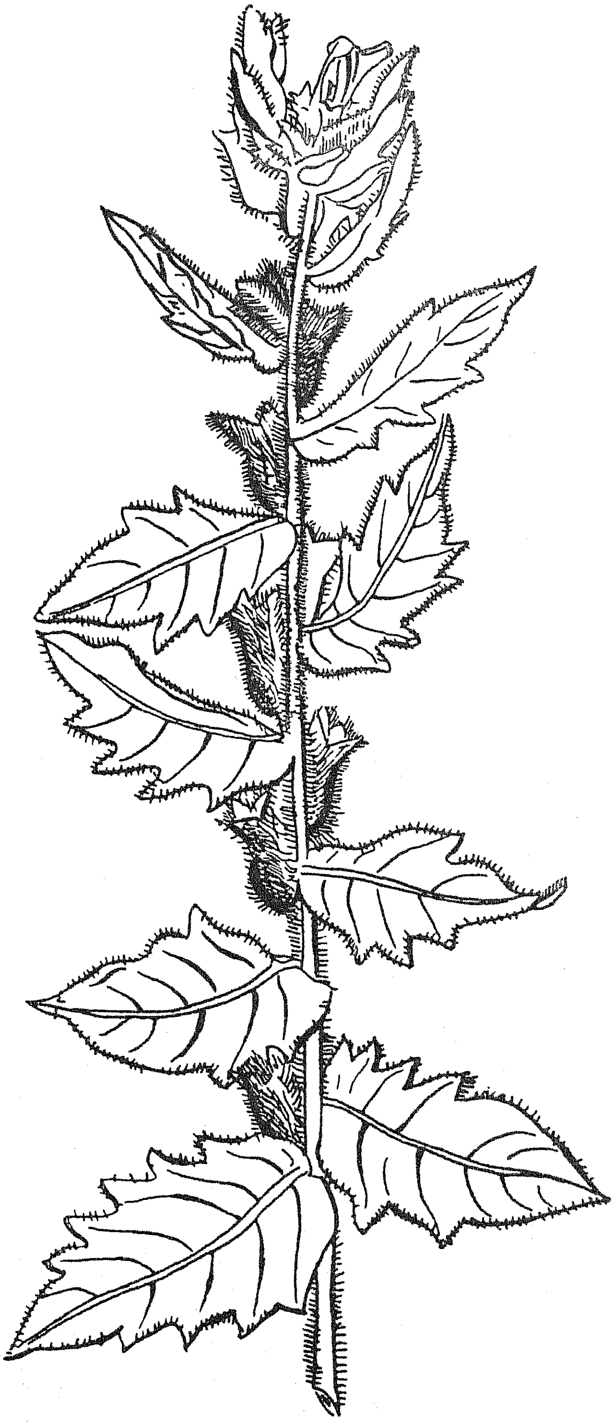
11. *Holarrhena antidysenterica* (Family : Apocynaceae ; Vern : *kurchi, indrajava*)

It is a small deciduous tree 10 to 15 ft. high with a smooth thick bark. It grows wild in the scrub forests of foot hills of the North-Western Himalayas and the Siwaliks up to 3,500 ft.

The long double pods and the bark are used in Indian medicine. The plant is easily propagated from seeds. The bark and seeds contain alkaloids and are effective in the treatment of amæbic dysentery.



Citrulus colocynthis Schrad. (Vern. *Tuma*) PLATE 10



Hyoscyamus niger Linn. (Vern. *Khurasani, ajwain*)

PLATE II

12. *Lallamentia royleana* (Family: Labiateae ; Vern : *tukham langa*)

It is an annual herb and yields small black seeds rich in mucilage. This plant occurs wild to a slight extent in the salt range, but responds to cultivation very well and is sown in the months of September-October. It is cultivated in small plots in Ropar (Ambala). It requires rich, loamy, well-drained soil and liberal irrigation. The seeds are sown broadcast at the rate of 3 to 4 lb. per acre. The crop is ready for harvest in April and yields four to five maunds of seed per acre. The seeds are very popular with the Indian drug sellers and are used for laxative and cooling effect and in flatulence.

13. *Mentha piperita* (Family: Labiatae; Eng: Peppermint; Vern : *pudina*)

Mentha piperita has been grown successfully in the Punjab during the past few years. It can be grown from plains to altitudes of 5,000 ft. It thrives on moist light soil.

The plant is propagated from runners which are planted in rows one foot apart. Planting is carried out in March-April. The crop is ready for distillation when it is in bloom about the end of June in the second year of planting. A second cutting can also be obtained in September after the rains. Cuttings are taken in the morning and the plants are left to wither in the sun and removed for curing and proper drying. The crop is well-dried before distillation.

The fields are ploughed after the second growth is cut in September. This breaks up the clumps, buries the surface runners and thus gives more vigorous stand in the coming year. In this way it can survive for four years after which it should be re-planted and manured heavily.

An yield of 60 to 80 maunds of herb mint per acre is obtained under favourable conditions. This will yield from 15 to 20 lb. of peppermint oil.

Mentha arvensis occurs wild in abundance in the Himalayas. Its oil is similar to the peppermint oil imported from the U.S.A. and Japan. The oil is a stimulant, carminative and antiseptic and used in throat lozenges.

14. *Psoralea corylifolia*. (Family : Leguminoseae ; Vern : *babchi*)

It is a shrub about 4 to 6 ft. high. Leaves are thick, shiny and bear black dots. It is a common weed in Rajputana and is well-known for its seed which is used as a medicine to cure leucoderma and leprosy.

Seeds which are small and black, contain essential oil which, in an ointment, acts against skin diseases. The plant should be cultivated for supply of pure seed.

The seeds are sown in March-April in lines one foot apart. About three seers of seed are required to sow an acre. The plant matures in November.

15. *Polygala chinensis* (Family : Polygalaceae)

It occurs wild in the Punjab from plains to altitude of 5,000 ft. The roots of this plant are used as a substitute for *senega* roots (*Polygala senega*) and has recently come into prominence for its usefulness. The roots are ready for digging when the plants are four years old. They are dug in winter, thoroughly cleaned and dried. The plant flowers in August-September. It has not been cultivated as yet. It is used as an expectorant and a purgative and in biliousness.

16. *Psychotria ipecacuanha* (Family: Rubiaceae ; Eng : ipecac)

It was introduced into India during the first World War (1914-18) and is cultivated in the Nilgiris and at Mungpoo near Darjeeling. It is very susceptible to frost. It is an emetic and is used in dysentery.

17. *Plantago psyllium* (Family : Plantaginaceae ; Vern : *kala* or *French isabgol*)

This plant has been introduced in the Punjab, and successfully cultivated for the last few years. Trials were carried out at Lyallpur, Multan, Gurdaspur and Rawalpindi. It does well on rich well-drained loamy soil and is fairly drought-resistant.

The seeds are sown in September-October by broadcast at the rate of 3 to 4 lb. per acre. The plant flowers in May, matures in June and yields six to eight maunds of seed per acre.

It is a new crop for India. Its seeds have not come into use though they have the same mucilaginous properties as *Plantago ovata*.

18. *Plantago ovata* (Family: Plantaginaceae ; Vern. *Isabgol*)

It is a small stemless herb found wild in sandy regions in the Punjab, Baluchistan, the North-West Frontier Province, Sind, etc. It has been cultivated in the Punjab and Baroda successfully to ensure supply of good seed. There is demand for it in the U.S.A.

Seeds are sown in October by broadcast at the rate of 5 to 6 lb. per acre. The crop matures in April and yields three to four maunds of seed per acre. The seed is used in medicine for its mucilage. Its seeds are well-known as remedy in dysentery and functional disorders of the digestive system. The husk of seeds is commonly used for these troubles.

19. *Podophyllum emodi* (Family : Berberideae ; Vern : *ban-kakri*)

It grows wild abundantly in the Punjab hills above 6,000 ft. in shady, cool localities. It is commonly met with in Kashmir, Murree, Dalhousie, Chamba, Kulu and Simla forests. The plant is propagated from suckers one foot apart, in rows 2 ft. distant, in the months of March-April. It flowers in May and the fruit ripens in June-July. It thrives in deep rich, well-drained soil with good forest cover and good supply of moisture. The roots take about two to three years to attain marketable size. The roots are used as a purgative.

20. *Rheum emodi* (Family: Polygonaceæ; Eng : rhubarb ; Vern: *rewand chini*)

It grows at elevations of 5,000 to 12,000 ft. It is also cultivated in hill stations for culinary purposes. It is grown from seed or from root suckers and thrives best in rich, light well-drained soil and sunny open places in hills. The plant takes several years to produce roots of the size suitable for marketing. There is a good scope for its cultivation. It is a popular Indian medicine for constipation.

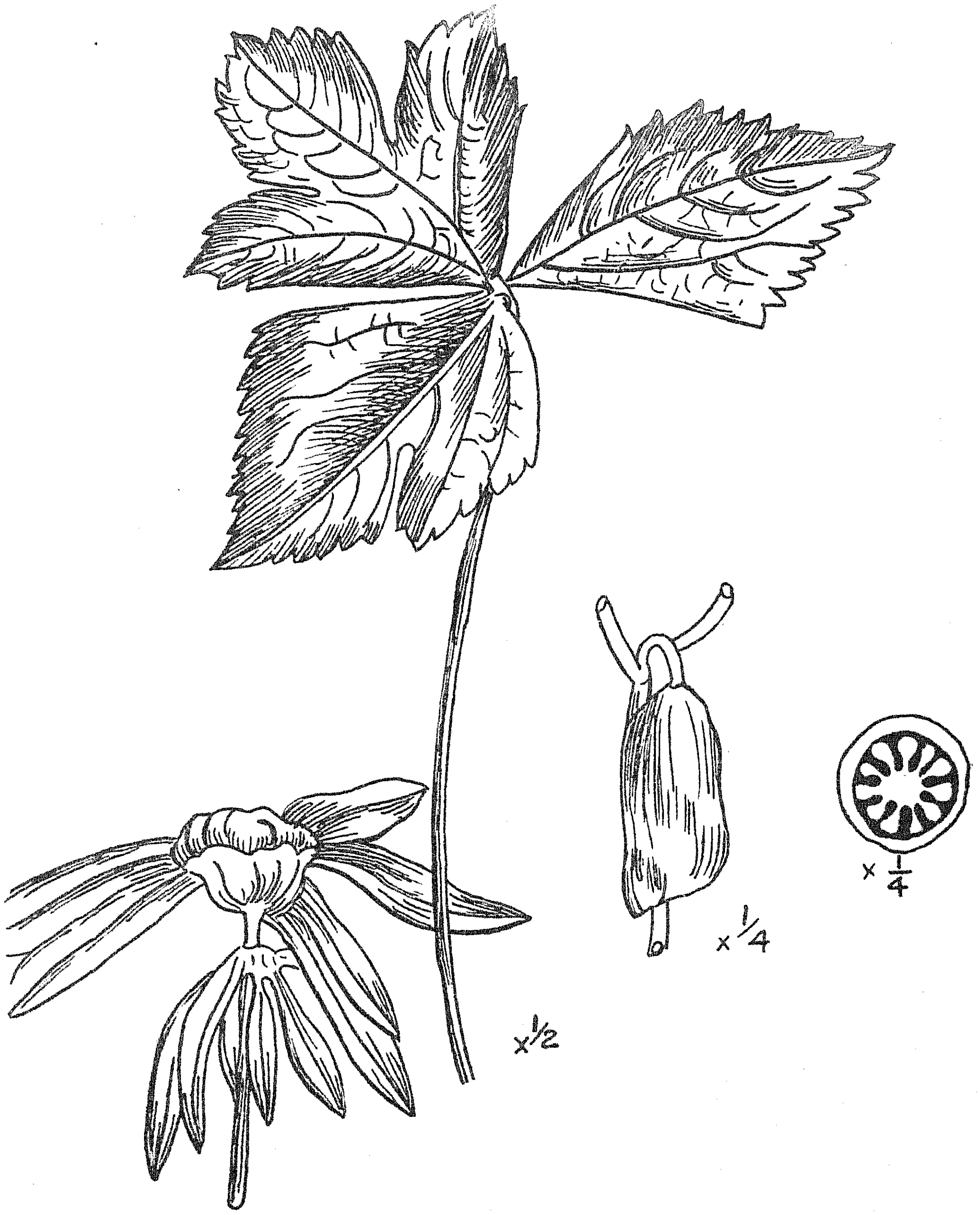
21. *Saussurea lappa* (Kuth) (Family : Compositæ ; Eng : costus root ; Vern: *kuth*)

It is a perennial, tall, stout shrub 6 to 7 ft. high, and grows well in hills at elevations of 8,000 ft. or above. It occurs wild in Kashmir and is cultivated in Chamba, Kulu and Lahoul valleys of the Punjab.

The plant is raised from seed and it takes three to four years to produce roots of marketable size. It grows on rich well-drained loamy soil with irrigation facilities. The roots are used in asthma, cough and rheumatism. In China it is burnt as an incense in temples as it has antiseptic properties.

22. *Swertia chiretta* (Family : Gentianaceæ ; Vern : *chirata*)

It is an annual erect herb 2 to 3 ft. high. It grows wild in the Himalayas at elevations of 5,000 to 8,000 ft. The plant is extensively used both in the indigenous and allopathic systems of medicine. It is used as a tonic, stomachic and against fevers and as an anthelmintic in the form of infusion. It is very common in the Indian bazars.



Podophyllum emodi Wall. (Vern. *Ban-kakri*)

HOW TO REEL SCIENTIFICALLY

By M. S. MADHWACHAR

THE silk industry, like several other ancient industries, owes its origin to China. The industry is said to have flourished as early as 2600 B.C. Even to this day the Chinese worship the Silk-Worm Goddess, the Empress Si-Sing-Chi, who is supposed to have first invented the art of reeling silk from cocoons and fashioned it into a garment. Since then, it has spread gradually to many parts of the world.

India is a nation of agriculturists. More than seventy per cent of the population lives on land. As such silk industry, which is predominantly agricultural, well appeals to the genius of our people. The sericultural industry, therefore, holds out a great future for the Indian farmer. The economic betterment of the ryot can only be achieved by maximizing the production on land and minimizing the hours of idleness on the part of the ryot. The silk industry comes in quite handy in supplementing his income.

The other and by far the most important factors for the growth of silk industry are the climate and temperature. It can thrive best in regions where there are a moderate rainfall, temperate climate and a soil retentive of moisture. These conditions are found in abundance in Deccan, the United Provinces, Assam and the Punjab. Consequently in these areas silk worms of various races can be successfully reared all the year round. Thus the industry may be developed in this country on a scale much larger and on lines much more scientific than at present.

Reeling

Reeling bridges the gulf between two classes of men—the countless millions of rearers or cultivators of silk cocoons on the one hand, and the manufacturers on the other. Reeling is either done by machines or country *charkhas*. Since the machine-reeled silk is infinitely superior to that produced by *charkha*, we shall deal chiefly with the machine-manufactured or the filature silk. It may however be mentioned that silk industry can also be carried on a small scale in villages.

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The yarn drawn from a country *charkha*, besides having several other drawbacks, cannot compare with filature silk as regards the uniformity of size, coilings, strength, compactness, lustre, tenacity and elasticity.

An estimate to run a filature of 200 basins

The estimated cost of running a filature of 200 basins is given below :

	Rs.
1. Buildings : Reeling theatre, cocoon stores, boiler shed, and office built on 20,000 sq. ft. @ Rs. 4-8 per sq. ft.	90,000
2. Erection of 200 basins, boilers, steam pipes and other equipment	125,000
3. Working capital for two months	300,000
4. Miscellaneous expenses ..	25,000
Total	5,40,000

Note : 1. The cost proportionately increases for the addition of every 100 basins.
2. The factory gives employment for 800 workers.
3. The annual output would be 600,000 lb. of reeled silk.
4. Thus the annual turnover would amount to Rs. 18,00,000, more than thrice the amount invested.

The actual working

Conditioning of cocoons : Conditioning is the first treatment given to cocoons by means of which the larva inside the cocoon is killed to minimize wastage and facilitate the drawing of silk yarn. When once the cocoon emerges it is unfit for reeling. So great care should be taken to see that the cocoons are conditioned at the right time. The cocoons are conditioned in two ways. One is by exposing them to strong sunlight in thin layers for twelve hours. The other and the more

scientific method is steaming them at the atmospheric pressure. This is done by arranging 20 to 25 bamboo trays in steam chambers and treating them with steam for 7-8 minutes. If more than this time is allowed, there is the danger of the cocoons suffering frequent brakes while reeling. One chamber can steam out 70 to 80 lb. of cocoons per hour. Thus it works to about 600 lb. being steamed during one factory day of eight hours. And for a factory consisting of 200 basins each consuming as much as 15 lb. of cocoons per day, five such chambers are necessary.

The cooking or softening of gum : Cocoons have in them a gummy substance known as 'sericin'. In order to render them into fabric it is necessary to degum the cocoons. It is noticeable that the industry involves utmost skill at every stage. The degumming is done in a basin served with two taps of different kinds. One tap supplies the basin with steam and the other with cold water. Cocoons are put in required quantities and cooked. Care should, however, be taken to see that they are not under or overcooked. Both result in adding to the stock of wastage. Uniformity in cooking is secured by employing a stirring rod. The properly cooked cocoons are made over by means of perforated ladles to the reeler. Before they are actually used in reeling the cocoons are cleansed of dirt and loose layers are pulled out and rejected. The rejected matter, thus removed, are converted into staples and dried and disposed of as raw materials for the manufacture of spun silk.

Actual reeling process

Before proceeding with the description of the actual reeling process, it may be useful to mention some important measurements of the modern reeling machine :

	Inches
1. Length of the reeling basin ..	30
2. Breadth of the reeling basin ..	12
3. Circumference of the drum wheel	54
4. Circumference of the friction wheel .. .. .. (the friction wheel runs three times faster than the drum wheel).	18
5. Circumference of the reel ..	59
6. Distance between the front set of pulleys (upwards) to the reeling basin-water	30
7. Breadth of each hank ..	$2\frac{1}{4}$

In all filature industry, reeling is the centre of interest. After ridding the cooked cocoons of dirt and waste matter, the reeler artfully collects all the starting points from the cocoons and goes on feeding the jets in the basin. Feeding requires skill and patience on the part of the skilled artisan. He must be ever vigilant to see that under each button there is just the given number of cocoons. These cocoons denote the size. They are also referred to in the technical language as the 'denier'. The other frequently used technical word is 'renditta'. Renditta denotes the quantity of cocoons necessary to produce one pound of silk, and also helps to determine the quality of the cocoons. Again the threads are coiled and passed on to the hanks through the distributors. To see that the proper size is maintained it is essential to have one supervisor for every twelve basins. As for the cookers, for a unit of twelve basins eight cooking basins are found to be adequate. It is also essential to regulate the speed of the reels. For a reel of 59 inches a uniform speed of 70 to 80 revolutions per minute is found to work well. Otherwise any increase will result in weakening the strand. The strength thus lost in reeling is never regained and the thread begins to run poorly at the weavers. At the end of the reeling period the hanks are removed and handed over to the examination section.

Knotting

The scientific reeling is full of skilled bits of little jobs. There is another little piece of work going on as the reeler is at his work. This job is known as knotting. Knotting consists of maintaining a continuity of thread without any breaks, complications or tangles. It is the duty of the knotter to see that the screws of each reel are tight. One knotter can easily look after half a dozen reels. In the event of any breakages or tangles, the particular reel may be stopped by means of the particular brake and the defect attended to. It is important to watch in knotting

that the thread always passes through the distributors. By this process the distributors prevent the thread from going outside the reels and also ensure uniform thickness along the width of the hank. If knotting is done carefully, even the suspicion of a knot cannot be discovered ; this is attained by skilfully cutting off any extra thread by means of sharp scissors.

Testing and packing

It is the careful and scientific examination of raw silk that ensures its high quality ; first testing as to the proper size is carried out at the time of reeling of the thread and the second one after the reeling has been completed. Tests are conducted with a view to discover bad casts, hairiness, loops and corkscrews; these are the result of inattentiveness on the part of the reeler, rotten cocoons and improper winding, etc. Some unwind easily while the others do not ; the latter case may be due to improper cooking. The defects of improper lacing, dropping thread, irregular traverse or short double ends should be set right while examining the hanks. After the hanks are cleaned the skinning section compresses five pounds of skeins into a book each and sends them on to the next section ready for sale or for further disposal. Such a fibre under a miscroscope is colourless, transparent, structureless and free from twists.

Today and tomorrow

Unfortunately modern silk industry of India is fast languishing. The producers, both the factory magnates and the small scale *charkha* reelers, are working under disadvantageous conditions ; there is no ready market to dispose of their wares. Moreover, during the war the industry did not receive any great fillip. The other cause of the decay is the inability of the industry to stand open competition. The labour charges in India today are much higher than in other silk-producing countries. To add to these there are brokers whose dealings unfavourably affect both the producer and the consumer. The result is that two millions of people who depend mainly on this industry are faced with a bleak future.

Effective State protection is absolutely necessary in order that the industry may come to its own and stabilize the economic position of those who depend on it. Government should come to the rescue by opening regulated markets in a few important centres. There the silk should be graded, tested and priced carefully. Of course expert supervision and vigilance is essential to achieve any success.

UTILIZING WASTELANDS FOR PASTURES AND FOR GROWING FODDER TREES

By R. C. KAUSHIK

EVERY village has usually a wasteland, which invariably is the common property of the peasant proprietors except in rare cases, in which it has been partitioned amongst them. These lands, which are often as productive as the cultivated ones, particularly in the plains, have been kept as such for grazing purposes. With the increase in population, the number of cattle has also increased and consequently the grazing incidence, as any increase in the area of the wastelands is out of question. Such wastelands on the contrary have decreased due to more area being put under cultivation. As the pressure on land increased, methods of cultivation improved. Seeds of improved varieties and strains of various crops are distributed ; the Agricultural Departments are teaching the tiller of the soil how he should maintain fertility of his soil to keep up the yields. Rotation of crops, green manuring, leaving the land fallow and giving it rest, anti-erosion and soil conservation measures, etc. are regularly advocated and put into practice to produce more food. But the increased pressure on the wastelands has not attracted enough attention of landowners even though a definite deterioration in the condition of these lands is apparent to everyone. The simple reason is that a common property is no one's property and every owner tries to exploit such lands as much as possible without taking into consideration the consequences that follow. Thus a much larger number of cattle has been maintained than is desirable. What can be the possible result of such action on the part of the owners and right-holders can well be imagined. As number of cattle increases, individual animals receive much less attention and their quality deteriorates ; on the other hand land gets no rest, the burden on it is more than it can be profitably placed, soil fertility decreases and soil itself is lost gradually as at some places it has already been lost or is being lost rapidly.

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In the circumstances it is not possible to apply the methods of scientific pasture management to these wastelands straightaway. Most of these lands have to undergo so to say a period of convalescence to recover full vigour before these can be put to use again. This is by no means an easy job. The peasant proprietors are ignorant and suspicious of any move for improvement and then also the interests of individuals have to be countered. It is necessary to introduce a complete change in the present methods of animal husbandry to disentangle the vicious circle. The aim is to produce the maximum possible yield of fodder grasses and leaf forage, to reduce the number of cattle and to make up any deficiency of livestock products by improving the quality of cattle. The means of attaining this aim are dealt with below.

Rest to land

A complete protection against grazing is the only way to give an opportunity to the deteriorated wastelands to improve. Better species of grasses grow up naturally, and the rest to the land will induce them to better growth and density. Convenient portions of a wasteland can always be set aside for rest as contemplated here.

Controlled grazing

The extent to which land can stand grazing is very variable and if the maximum utilization is aimed at, it is indispensable to adopt a rotational grazing scheme and to ensure proper incidence of grazing.

Soil and water conservation

Soil fertility and soil moisture control the yield and quality of grasses and trees. The

wastelands ought to be divided into small divisions, perferably on contour basis to help bringing about equal distribution of water, holding all rain water and putting a stop to the carrying away of top soil by run-off water.

Contour ridging, contour trenching, ploughing in rotation, etc. are the methods to conserve soil fertility and moisture. Along the trenches and ridges fodder trees can be planted which will also provide shade to reduce the surface evaporation.

Planting of fodder trees and grasses

Broadcasting of grass seeds in a closed and compact area, preferably with broad ploughing or harrowing, and planting of fodder trees around the boundaries, both carried out on plots scattered all over a wasteland, ensure a plentiful supply of grass and leaf fodder and a better management of pasture land. A rotational lopping scheme for any fodder trees already existing is essential to produce more forage and to allow the trees to regenerate naturally.

Elimination of competition

Useless trees and shrubs tend to spread in wastelands and these must be eliminated to utilize every bit of land for fodder production.

In short the present malpractices which do not permit wastelands to produce the maximum grass and forage should be stopped, and scientific management introduced to make their fullest utilization possible. Intensive education and propaganda, organization of *panchayats* and cooperative societies or managing committees must be undertaken before any substantial work can be done on the wastelands in the direction of fully utilizing them for pasture or for growing fodder trees.

EXTENSION SERVICE

THE Government of Bombay has organized a Urban Volunteer Corps, called the 'Kisan Sahayak Dal' to assist the farmers in the 'grow more food' work. In the districts the work is undertaken by the District Rural Development Boards and in Bombay city by the Director of Parks and Gardens. The Provincial Agricultural Department is also in contact with progressive farmers with a view to demonstrating on their farms the intensive cultivation programmes recommended by the Government. The services of the Home Guards Organization are also being enlisted in the 'grow more food' campaign, planting of trees, helping the villagers in repairing small irrigation tanks and similar other work are being taken up by the Guards. (*P.I.B.*)

THE PLACE OF ALGOLOGY IN AGRICULTURE, INDUSTRIES AND FISHERIES*

BY ELLA A. GONZALVES

IN these momentous times, it is vitally essential for our country to aim at self-sufficiency, and so plans for its industrialization should proceed apace. The first task that confronts us, however, is to take stock of our potential resources. No asset, however insignificant, should be overlooked. Continuous efforts should be made to find out in what manner we can utilize resources, hitherto unused or little used, so as to derive the utmost return from them.

Algology deals with the lowest forms of plant life but, though lowly, these forms can be used to an immeasurable extent for agricultural and industrial purposes. The recent war gave the necessary stimulus to research on algae and led to a realization of the tremendous commercial possibilities in them, particularly in the marine algae or seaweeds.

Agricultural and industrial uses

For centuries, seaweeds have been used as fertilizers in certain countries, as they provide both mineral salts and other materials to the soil. Cattle and poultry, when fed on a diet to which seaweed meal has been added in small quantities, show improvement in health and increase in weight and fertility. That is why in certain parts of the world, sheep are sent to graze on seaweeds, exposed at low tide on the rocks. Some species of seaweeds can also be utilized as fuel.

Though the marine algal flora of the Tropics is not as prolific as that of the temperate regions, yet in certain places on our coasts, there is a rich development of algae. In such places, the agriculturist who, as a rule, finds it difficult to wrest a living from the soil, could profitably make use of the wealth of algal material to enrich his soil by manuring and to provide food for his animals and fuel for himself. And if he could cultivate in himself a taste for seaweeds, the edible varieties could form a welcome addition to his present meagre diet ; for in many parts of the world, such as China and Japan and other tidal zones of the Atlantic and Pacific Oceans, seaweeds are used as food. Even in some places on the coasts of Scotland and Eire, they are eaten as vegetables. It has been claimed that they are especially rich in vitamins A and E. However, their proper nutritive value has not been definitely ascertained.

It is generally known, that till quite recently, the brown seaweeds were the main source of the element iodine. Though the bulk of iodine is now obtained as a by-product in the crystallization of nitrate from Chile, a small proportion of iodine is still obtained from seaweeds. Some of the red algae too, like *Rhodymenia* and *Phyllophora* are now found to be rich in iodine, the Russians particularly employing them for the extraction of iodine and other elements.

A very important substance secured by processing brown seaweeds in a particular manner, is algin or alginic acid, which is a component of the cell-walls of seaweeds. It is a thick, slimy substance, which, when treated in different ways, yields substances which can be put to a variety of uses. It serves in pharmaceutical and cosmetic preparations and is also employed as a waterproof material and as a sizing material for cloth. It is used extensively in the preparation of restaurant delicacies like cakes, jellies, icings, etc. After treatment with a mixure of strong caustic soda and tannin, algin yields a transparent substance, very much like cellophane, useful as a

* Paper read at the discussion on 'The Application of Botany to Industry' before the Botany Section of the Indian Science Congress held at Delhi in January, 1947.

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wrapping material. It has also proved of incalculable use in the preparation of insecticides and in the manufacture of polishing creams and can-sealing compounds and plastics, rollers for typewriters and other articles in popular use, too numerous to mention.

In recent years, an excellent type of artificial silk or rayon has been produced from alginic acid, which has excellent qualities. It is easily spun and dyed and possesses very satisfactory elastic properties for weaving and knitting. Being totally inflammable, it was widely used during the war in connection with the camouflage of guns. Seaweed rayon therefore has an assured place in the textile market of the future.

The red seaweeds are also of economic importance. *Gloeopeltis* has been used by the Japanese for making cement. The best known product, however, obtained from the red seaweeds is agar-agar, the higher grades of which are used in the laboratory as culture media. The lower qualities are used as adhesives and varnishes and for sizing paper and cloth. Before the war, agar-agar was obtained chiefly from Japan from the seaweeds *Gelidium*, *Gracillaria*, *Gigartina* and others, but when the Japanese supplies were no longer available, attempts were made in different countries to find suitable substitutes for it. The result is that now agar-agar can be obtained from England, Scotland, Eire, South Africa, New Zealand and the Pacific coasts of America. Thus new industries have developed in these countries. Realizing the commerical possibilities of seaweeds, many countries have established councils and associations to conduct surveys as also to safeguard supplies of this vital material. It is interesting to note that these bodies not only devote their attention towards finding methods for using seaweeds, but first they undertake an extensive and complete systematic survey of the seaweeds for the purpose of classification, assessment and location. Next, information is gathered about the requirements of seaweeds for healthy growth. Thus fundamental research goes on side by side with applied research.

Possibilities in India

The algal flora of the Tropics, as mentioned before, are not as luxuriant as that of the temperate regions, nor are they characterized by the gigantic members of the brown algae, which usually flourish in the cooler waters. In the Tropics the Rhodophyceae are dominant. The Phaeophyceae are represented by members of the Dictyotales and species of *Sargassum* and *Turbinaria*, while there is an abundance and variety of *Siphonales*. Hence in India, perhaps, the exploitation possibilities of seaweeds for commercial purposes will be limited. However, since the Rhodophyceae are available in large numbers, industries for the manufacture of products from this group of algae can be easily started. Similarly, the available smaller species of the Phaeophyceae can also be utilized for industrial as well as for other purposes ; for it has been shown that the percentage of algin extracted from the smaller members of the brown algal group, such as occur in India, does not fall far short of that yielded by the giant members.

In India, therefore, we must first have an assessment of our seaweed resources, for Biswas (1943)[1] estimates that more than 75 per cent of the marine and freshwater algae of the country are not known to us. All available seaweeds must be identified and classified. Once a thorough survey of the seaweed flora is accomplished and exact data collected with regard to the volume available at particualr places and the amount that could be utilized for commercial and agricultural purposes, the next step will be to formulate plans for the most economic methods of collecting, transporting and utilizing the seaweeds. In places where there is excessive growth of algae, seaweed farms can be established. Algal cultivation has been practised in the Far East for ages. In these farms the more valuable kinds of seaweeds are cultivated, so as to meet agricultural and commercial demands. Some of these seaweed farms are situated at considerable depths below the surface of the sea, and diving equipment has to be used for tending the crop. If established in India, not only will such farms ensure supply of seaweeds, but a fresh avenue

[1] Biswas, K. (1943). Systematic and Taxonomic Studies on the Flora of India and Burma. Presidential Address to the Section of Botany, *Proc. of the 30th Ind. Sci. Cong.*, Calcutta, P. 135.

of employment will be provided to our people.

Another product of commercial importance is diatomaceous earth which consists of deposits of fossil diatoms. It is usually marketed in various forms such as powdered earth, calcined granules, manufactured bricks, etc. Though the oldest commercial application of diatomaceous earth is that of a mild abrasive in metal polishes and tooth-pastes, its other uses are wide and varied. It has been used as an absorbent for liquid nitroglycerine to make an explosive dynamite, which can be safely transported. In sugar refineries it is used during the process of filtration to screen out the suspended material present in sugar solutions. Where high temperatures (over 1,000° F.) are required, as in boilers and blast furnaces, it is used as an insulator as it is more efficient than either magnesia or asbestos. If added in small amounts (about 1-2 per cent) to cement, it increases the mechanical strength of cement as also the workability of concrete. Diatomaceous earth is thus a material the commercial possibilities of which are vast. According to Biswas (loc. cit.), it may be discovered in the vicinity of the Andaman and Nicobar Islands.

The place of algology in fisheries is no less important. Though continuous and systematic attempts have been made throughout the ages to develop both our animal and vegetable food-yielding sources, the sea fish food is still obtained by the primitive method of hunting and in circumstances which cannot be controlled. In recent times, however, experiments have been successfully concluded which will transform the fishing industry in every country of the world. The supply of fish in the sea can now be controlled and augmented in the same manner as agricultural produce. The basic principle underlying these experiments is that the sea can be regarded as a huge meadow, in which the plankton or microscopic, drifting organisms, form the elemental food of the larger animals. They are thus the first and most important link in the food-chain of life in the sea. The number of fish in the sea has been found to depend on the amount and richness of the plankton, especially the phytoplankton. It has further been found that periods of fish scarcity coincide with periods when there is an appreciable decrease in the numbers of the plankton or when they disappear totally. The reduction in numbers again, has been traced to the disappearance of certain essential plant foods, such as nitrogen and phosphorus from the sea. If, therefore, the supply of these foods is maintained throughout the year or if the supply can be increased by fertilizing the water artificially so that a well-balanced food-chain is set up, the fish population will be provided with enough food to grow and flourish throughout the year. Experiments carried out on these lines in Scotland were extremely successful. Counts made of the number of plankton organisms after fertilizing the waters showed an increase of 500 per cent and the fish in such fertilized waters reached marketable size in three years instead of six. These experiments have been successfully repeated in selected tracts of sea, so that it is now an established process to increase the food productivity of certain chosen tracts of sea by the addition of fertilizers.

The fishing industry is next to agriculture and perhaps animal husbandry the third largest industry of India. Though India is not essentially a fish-eating country, its extensive coast line consists of shallow shores which can make ideal fishing centres, and yet the majority of our fishermen eke out a miserable existence, getting barely enough for their subsistence. It is, however, gratifying to note that the Fisheries Departments in India have considerably widened the sphere of their activities. Experiments conducted on the above lines should yield excellent results in India, particularly as the plankton population in tropical waters is supposed to be much less than that in temperate waters and thus, an increase in the numbers of plankton organisms, as a result of fertilizing the waters artificially, would be definitely beneficial to the growth of fish. It is, however, essential that the sites for experimental farms should first be carefully selected. They should be situated where other factors such as currents, bottom fauna and the plankton are already present and afford the best possibilities of success. Further, a thorough investigation of the plankton of our shores, their seasonal distribution and composition should also be undertaken. In

foreign countries, numerous investigations have been carried out on phytoplanktons. They have been studied from almost every angle and research on them has reached a superlative degree of excellence. Work on these lines will have to be repeated in India in order to obtain results of lasting importance.

Similar schemes can be adopted with regard to freshwater fish ponds. Experiments carried out at the Alabama Agricultural Experiment Station [2,3], U.S.A., on fish-pond management have shown that by fertilizing fresh water with chemicals, the supply of food, i.e. the plankton in ponds is increased and as a result larger numbers of fish are supported. The Station gives information as regards the type of fish that should be stocked, fertilizing of water, weed control and other factors of importance in maintaining a proper fish-pond. In certain parts of India, fish ponds are becoming more numerous and in many provinces, the Fisheries Departments are encouraging the stocking of the existing tanks and ponds with fresh-water fish. Manuring of such ponds is also being carried out. If in India, farmers are encouraged to start fish ponds and are instructed in their proper construction and management, fish-farming will soon become popular and farmers will find that by expending only a moiety of the labour they put into their soil, they can reap quite a substantial return. These are some of the ways in which we can utilize the material available in the country and at the same time go far forward in our schemes for its industrialization.

2. Davison, Verne, E. and Johnson. J. A. (1944), Fish for Food from Farm Ponds, U. S. Dept. of Ag. *Farmers' Bulletin* No. 1938.

3. Swingle, H. S. and Smith, E. V. (1942). Management of Farm Fish Ponds, *Ala. Agric. Expt. Sta. Bul.*, 254

ALLOCATION OF SULPHATE OF AMMONIA

IN the allocation of sulphate of ammonia during the current fertilizer year (July 1949 to June 1950) special attention has been given to the requirements of commercial crops. Sixty-eight thousand tons, representing more than one-third of the total quantity so far available have been allocated for tea, coffee, jute and cotton. The quantities allocated are: Tea—30,000 tons ; Coffee—5,000 tons ; Jute—15,000 tons ; and Cotton—10,000 tons. In addition, a quantity of 8,000 tons has been given to the United Planters' Association of Southern India and another 3,000 tons have been given to the industries in general for various industrial purposes. (*P.I.B.*)

INTERNATIONAL TRAINING CENTRE ON CENSUSES AND STATISTICS

By D. Y. LELE

ON 1 November, 1949 an event of first-rate significance in the field of agriculture took place in India. This was the inauguration of the International Training Centre on Censuses and Statistics under the auspices of the Indian Council of Agricultural Research.

Concept of census

The concept of censuses as applied to population must be familiar to readers. A population census is taken in our country every 10 years, the one due in the near future being the one contemplated in 1951. Such a census gives an integrated picture of the population, about its composition in regard to races, religions, sexes, age and income groups, etc. and is of great value to the administration.

Extension to agriculture

What is of significance today is that an attempt is being made to extend the idea of census to other fields of life ; in particular to the field of agriculture. A census covering various aspects of agriculture would be an inventory of a nation's agricultural resources, of its producing areas, of livestock, of the people directly employed in agriculture, of conditions of land on which they work, of their animal and mechanical equipment, of the food position and of the economics of agricultural practice and produce. At present only a part of this information is being collected in the country and that too not on a uniform basis for all the areas. But the real drawback so far has been the lack of correlation of the data collected with the economic status of the agriculturist. This essential lack is sought to be rectified in the contemplated agricultural census by providing an integrated picture of agricultural economy. In a nation like ours, where almost nine out of every ten persons live on agriculture, the need for a stock-taking of the all-round agricultural position, which will reveal the country's economic structure and provide a sound basis on which to build up our future plans and agrarian legislation, should indeed be obvious.

Though an agricultural census is yet to be a familiar concept with us, such censuses have been undertaken much earlier in other countries of the world. When the International Institute of Agriculture in Rome thought of initiating periodic world census of agriculture in 1930, it was found that in as many as 37 countries of the world, such a census had already been undertaken at least once. The International Institute's programme was impeded by the development of events in the world with which everyone is familiar. When, however, the Food and Agricultural Organization came into being in 1945, to devise ways and means of improving the position of food and agriculture in the war-ravaged world, one of its early decisions was to reinstitute the programme of a uniform periodical census of agriculture throughout the world. It recommended that such a census should be organized in 1950 or thereabout by all member-countries.

Difficulties in the way

The novelty of such a project and the cost which its operation was bound to entail were, however, not the only two difficulties that stood in the way of the willing acceptance of the programme by the various countries of the world. An obstacle of primary importance for many of the countries was the lack of technically trained personnel for successfully organizing and planning so colossal a project. The shortage of technical personnel has been particularly acute in the comparatively under-developed coun-

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A view of the distinguished gathering on the inauguration day.

Another view of the same gathering.

tries. The Food and Agricultural Organization, therefore, decided to organize training centres for the benefit of such countries, one each in the different regions of the world, so as to provide each country with an opportunity to have a team of persons well-trained in the methods of planning and organizing such a census and thus to be in a position to assume responsibility for this work in 1950. Four such training centres, one each at Baghdad, Mexico, Paris and Cairo, have been organized so far and the present centre is intended to serve the needs of countries in South-East Asia and Oceana. The Government of India readily agreed to cooperate with the FAO in sponsoring and organizing such a centre in this country not only because of its immense utility to us, but also because of the opportunity inherent in such a programme of being of some service to our neighbouring countries and of gaining by mutual experience.

The Training Centre

Since the population census is also to be undertaken in 1951, it was felt advisable to combine the course of training in the conduct of population census with the training in agricultural census. An indispensable part of the training will be a study of modern statistical methods which are our only guide in wading our way to reliable conclusions through masses of quantitative data collected. The Indian Council of Agricultural Research are in charge of the general administration of the Training Centre, while its Technical activities will be under the supervision of a Board of Directors comprising of specialists in the subject from India as well as from the UNO, FAO, and ECAFE. The experts representing India are Prof. P. C. Mahalanobis, Mr. W. W. Yeats and Dr P. V. Sukhatme, whereas the International Agencies are represented by Dr Maurice Hansen, Dr Chr. P. G. Smith and Mr. C. K. Dilwali. The Training Programme is expected to last for a busy 16 weeks.

Inauguration

The Centre was inaugurated by the hon. Shri Jairamdas Daulatram, Minister for Food and Agriculture, Government of India, in the Council Hall at New Delhi. The function was very well-attended not only by the numerous officers representing the various Ministries of the Government of India but also by representatives from various foreign Embassies. Amongst the distinguished guests present may be mentioned, Sir T. Vijayaraghavacharya, the first Vice-Chairman of the Indian Council of Agricultural Research.

The function began with a recitation of Tagore's *Jana Gana Mana*, after which Shri S. M. Srivastava, Joint Vice-Chairman of the Indian Council of Agricultural Research read his welcome address. He expressed regret for the absence of Sardar Datar Singh, Vice-Chairman of the Council, who, owing to indisposition, was unable to participate in the function. The Joint Vice-Chairman traced the history and development of the training school and familiarized those present with the facilities which the Council has been able to place at the disposal of the trainees for their benefit during the course of the training programme. He explained how the training programme would cover a comprehensive field including the planning, organization and conduct of censuses and maintenance of periodic statistics in the backgrounds prevailing and facilities obtaining in the various countries. The special feature of the programme, he said, will be to emphasize the role of sampling in censuses and collection of general agricultural statistics in which the two pioneer institutions in India, namely the Indian Council of Agricultural Research and the Indian Statistical Institute, have had considerable experience. Ample instructions in laboratory and field work would be provided along with theoretical training and he expressed the hope that the delegates would even have an opportunity of participating in a miniature experimental census in villages around Delhi. This would help them to compare conditions in this country with those of theirs, and thus would contribute to mutual understanding and education. To lend comprehensiveness to the course, he added, extra mural lectures on statistical organizations and services and on various allied subjects by a number of experts from various Ministries and Institutions in India were also being arranged. He was sorry that a number of countries invited were unable to join, owing to unforeseen

circumstances as also because some of them had just completed their censuses. However, he was very glad that the countries of Burma, Ceylon, Indonesia, Korea, Nepal, Pakistan and Thailand had found it possible to participate in the Training Centre.

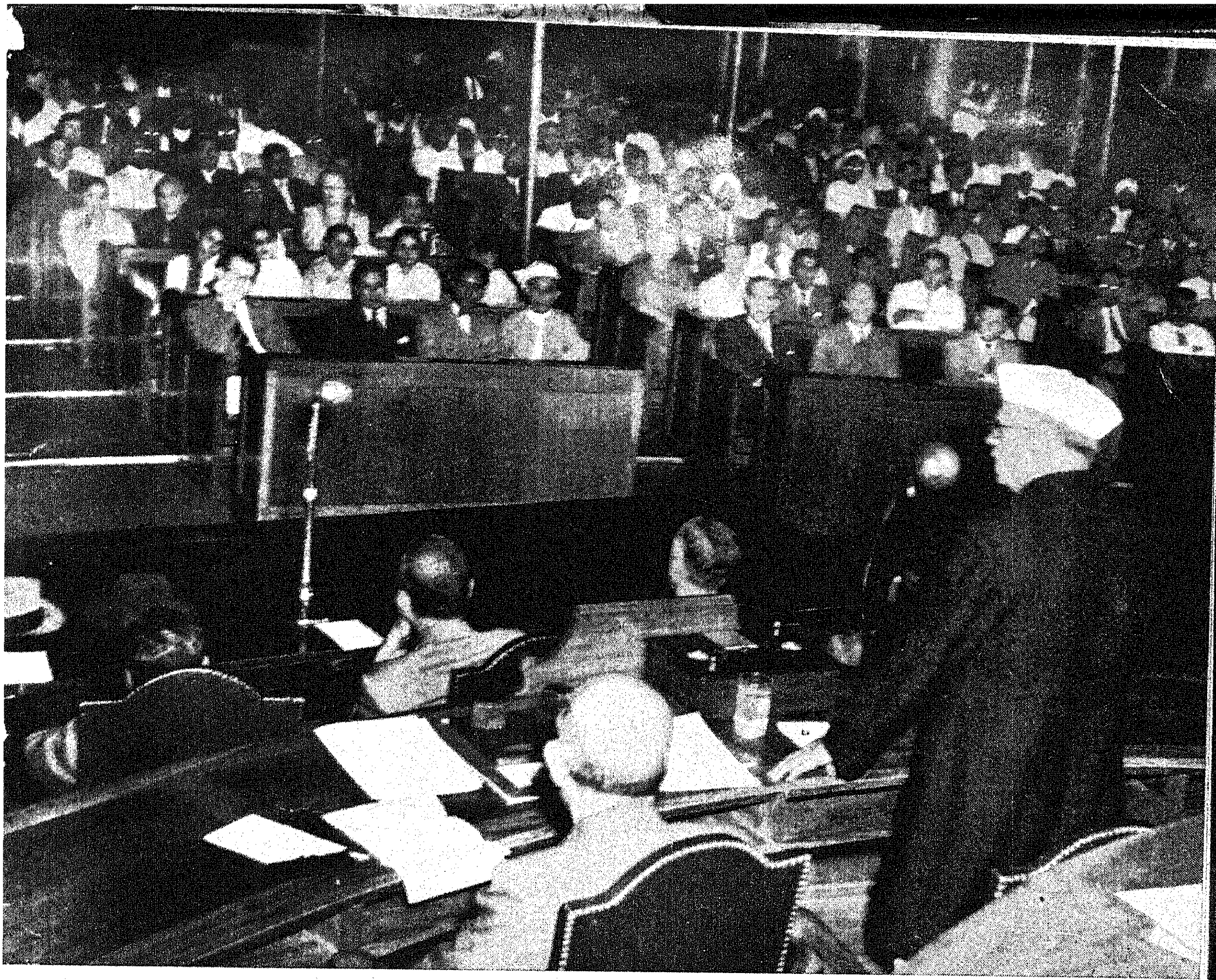
The hon. Shri Jairamdas Daulatram characterized the opening of the Centre as a very important and happy event in that India and her neighbours had an opportunity to live, study and plan together to overcome national barriers and apply themselves to the task of serving the common man by means of their joint participation in this technical programme. He emphasized that the connection between this work and the needs of the common man was not so remote as many might be led to believe.*

Dr H. R. Tolley, Director of Economics and Statistics, FAO, spoke on behalf of the International Agencies. He congratulated the Government of India on their spirit of international cooperation and expressed gratitude for their very substantial contribution in organizing the Centre. There was growing awareness, he said, on the part of Governments and peoples regarding the need for comprehensive and reliable facts ; in other words, for dependable statistics. The agricultural census of 1950-51, recommended by the FAO, was in pursuance of this universal need and was not to be thought of as divorced from the requirements and the urgent problems of the various countries. He briefly mentioned, by way of introduction, the outstanding contributions in the field of statistics made by the various experts that were available as guides and congratulated the trainees on having the benefit of their guidance. He was sorry that he could not remain throughout the duration of the course, the more so since he would be thus losing a great opportunity of learning about the economic and social problems of the countries in this region. He felt confident that on return to the respective countries, the delegates would apply themselves to the task of organizing the statistical programmes of their countries as will be in keeping with the objective of providing basis for realistic policies in the national and international spheres and improvement in human welfare. He hoped that more such training centres will be ushered in, in the future, with cooperation of the member-countries.

Prof. P. C. Mahalanobis followed Mr. Tolley. It was gratifying to him as a Statistician, he said, to be associated with this enterprise, because collection of reliable information was essential for the successful working of any policy and reliable information could not be had unless trained personnel well-versed in the technique of collection of the same was developed. He was also glad as an Indian because India had an opportunity to be of service to her neighbouring countries. He hoped that the host country as well as the guests would profit by mutual exchange of information.

The function came to a happy conclusion after a vote of thanks by Shri T. S. Krishnamurti, Secretary of the Council and the Administrator of the Centre.

*The speech by the hon. Shri Jairamdas Daulatram is reproduced as a leading article in this issue.



The hon. Shri Jairamdas Daulatram delivering his inaugural speech on the occasion.

The hon. Shri Jairamdas Daulatram along with Shri S. M. Srivastava and Shri T. S. Krishnamurti of the I.C.A.R. and others arriving to inaugurate the International Training Centre on Census and Statistics at New Delhi.

RESEARCH ON THE STORAGE OF GROUNDNUTS IN MADRAS PROVINCE*

GROUNDNUT kernels exported from the Madras ports are reported at destination to contain a very high percentage of free fatty acids, and fetch correspondingly low price. It was estimated at one time that because of the poor quality, the Indian groundnut trade was losing annually to the extent of about six millions of rupees.

The deterioration of kernels is attributed to the unscientific methods of decortication and storage practised by the trade. Kernels stored especially in port godowns have been observed to deteriorate considerably in quality due to a variety of causes, such as the condition of the material at the time of storing, type of bedding material used, nature of flooring, the height to which bags are piled up, etc. Kernels which are not properly dried were said to develop free fatty acids at a rapid rate and also to cake up in storage. Damage due to rise of dampness from the floor during rainy seasons is also estimated to be considerable.

Under the scheme of research on the storage of groundnuts run for a period of four years, from 1943 to 1947, with the financial assistance from the Indian Council of Agricultural Research, the various problems connected with the storage of groundnuts were investigated in detail. Representative lots of two important commercial grades of groundnuts, viz. Coromandel and Peanut were stored under actual godown conditions in the ports at Masulipatam and Cuddalore and also at Tindivanam under different systems of storage obtaining at present, and the progress of deterioration (development of free fatty acids, damaged kernels and incidence of insect pests) was studied. Investigation on the working of the groundnut decorticators was also carried out in order to suggest improvements in decorticating practices. The following are the important findings of the investigations which will be of use for those connected with the production and marketing of groundnuts.

1. Groundnut is mostly raised as a rain-fed crop in the province from July to December. It is also grown on a small scale in certain districts like South Arcot, North Arcot, Trichy, Coimbatore, etc. in summer (February-July) under irrigated conditions. Groundnut kernels obtained from the crop raised in the summer season gave about two to three per cent more oil than that raised during the rain-fed season. But the increase in free fatty acids and insect attack was much more in the summer produce than in the winter produce. The loss of material at the end of 10 months of storage amounted in the case of the summer produce to $17\frac{3}{4}$ lb. per bag of 177 lb. while the loss was $15\frac{1}{2}$ lb. in the case of the winter produce.

2. Even though it is generally admitted that all produce intended for storage should be well-dried, it is not uncommon to store partially dried material. Studies in storage conducted showed that the moisture content of the produce at the time of actual storage was the most important predisposing factor for deterioration of groundnuts. The kernels with a moisture content of seven to eight per cent (or a shrinkage of two to three per cent) developed heat on storage ; the kernels of the bottom bags appeared fire-fanged and caked up at the end of ten months of storage.

*Oilseeds Series No. 10 issued by the Indian Central Oilseeds Committee.

The free fatty acid content was also very high. The condition of fully dried kernels, containing five per cent moisture, was comparatively much better at the end of storage. The loss of material due to drying and insect attack in the partially dried kernels stored for a period of ten months was as high as 28½ lb. per bag of 177 lb. in the Coromandel variety and 17½ lb. in Peanut ; while it was only 17 lb. and 12 lb. respectively in well dried kernels.

3. Some sort of bedding material is invariably used at the time of stacking groundnut bags whether the floor is *pucca* or *kacha*. Sand covered over with gunny cloth, railway cinders, groundnut shell and coir matting over cement floor are some of the bedding materials in general use. The investigation on deterioration of groundnut kernels stored on the different bedding materials showed that hard bedding materials like coir matting on hard floor and railway cinders were rather unsuitable for the purpose ; caking up of kernels and damage to gunnies of the bottom layer of bags were always more pronounced in these cases. Further insect pests were seen to breed in larger number in the bedding of coir matting and groundnut shell. All considered, sand covered over with gunny appeared to be the best dunnage material for stacking groundnut kernels packed in gunny bags.

4. The caking up of kernels and the damage to gunnies of the bottom bags were found to be almost proportionate to the height of stacking. The damage is appreciable when the bags are piled up to a height of more than 10 bags, particularly when the stacking is done on hard bedding materials like coir matting on hard floor and railway cinders.

5. Largescale storage in port godowns is confined to kernels only. During decortication or shelling of pods either by hand or by machine, large quantities of kernels get split or broken into small pieces. The extent of breakage is influenced by the moisture content, the type of decorticator used and the care and attention bestowed during decortication. The study of the deterioration of kernels under storage showed that deterioration was directly proportional to the extent of the broken components in the produce. When these broken and split kernels were present to the extent of 75 per cent, the loss due to driage and insect attack was as high as 20 lb. at the end of 10 months' storage for every bag of 177 lb. stored ; it was only 9 lb. in the produce composed of whole kernels only. Split and broken kernels were found to deteriorate more rapidly in storage than the whole kernels.

6. The efficiency of containers such as gunny bags, basket bins and mud bins for the storage of groundnuts both as pods and kernels was investigated as also loose storage without containers. Storage in the form of pods, served to reduce deterioration and loss to an appreciable extent. Among the containers mud bins appeared better for kernels. However, the practicability of their adoption in largescale storage is very limited.

7. For machine decortication Kirloskar's 'Kalyan', Dandekar's 'Sangli' and 'P. S. G.' are the important makes found in general use. An investigation into their working showed that the first one was superior to the other two because of the fact that it gave higher outturn per hour and breakage of kernels was low. Certain glaring defects in the working of decorticators were noted such as working the decorticator at high speed, unregulated feeding of groundnut pods into the machine, use of improper size of sieve and want of timely replacement of worn-out parts. These should be remedied if the quality of kernels turned out by them is to be substantially improved.

8. The deterioration of kernels stored in gunny bags in well ventilated and periodically cleaned godown was also investigated, particularly in regard to the incidence and spread of pests. It was found that to be really effective, such measures should be followed by all godown-owners in a locality, for the insect pests were found to migrate from one godown to the other.

It may be seen that the above observations made during the progress of the storage experiments are of considerable practical importance. The following suggestions are made regarding the steps and precautions to be taken by the producers and dealers of groundnuts in order to improve the quality of groundnuts marketed :

(i) The groundnut crop should be harvested only when the crop is fully mature. Early harvest will result in a high percentage of shrivelled kernels and free fatty acids and relatively low oil content.

(ii) The produce should be dried thoroughly soon after harvest. All produce intended for storage should be well dried and should not contain more than five per cent moisture.

(iii) As far as possible groundnuts should be stored as pods (nuts in shell) rather than as kernels even though more room will be required, for storing pods.

(iv) If groundnuts are to be stored as kernels, care should be taken to get them decorticated properly so as to reduce the proportion of split and broken kernels in the decorticated material. It is also desirable to reduce the period of storage of kernels as far as possible.

(v) Storing of groundnut kernels on hard flooring or hard bedding material and piling bags too high should be avoided to minimize caking up of kernels and damage to the gunny bags. Some 15 layers should be the optimum. Among the different dunnage materials now being used by the trade dry sand to a depth of about a foot and covered over by clean gunny cloth appears to be the best.

(vi) The produce of the summer crop should not be stored for long periods as it has been found to deteriorate faster than the produce from the winter crop. The summer crop is better utilized for local crushing.

(vii) All godowns where groundnuts are to be stored should be *pucca* with smooth plastered walls and rounded corners and should be rat-proof. Fairly high basement should be provided if the godowns are built in low lying localities subject to the rise of the water level during rainy seasons. The godown including dunnage materials should be cleaned and disinfected by fumigation before storage. It is also desirable to clean the godowns periodically and destroy pests.

(viii) Containers such as gunny bags, bins, etc. used for the storage of groundnuts should be cleaned beforehand and should be free from all pests. For storing small quantities of groundnuts in villages mud bins appear to be the most suitable.

(ix) Among the groundnut decorticators in use, the 'grate type' is found to be more suitable in that the percentage of split and broken kernels is comparatively less in this type as compared to the 'beater type'. Regulation of the speed of working of the decorticators and proper adjustment of the machine to suit the size of the groundnut pods to be shelled will reduce the percentage of the split and broken kernels in the decorticated produce.

The directions given here do not involve any appreciable increase in expenditure and if those connected with the production and trade in groundnuts only make a determined and conscientious effort to adopt these precautions, it should be possible to improve within a comparatively short time the quality of groundnut kernels marketed and thus to reduce the loss that India is sustaining at present on account of the poor quality of groundnut kernels.

You ask We answer

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in States. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

Anaphylactic Shocks in Animals

Q. What is the cause of instantaneous shock in certain animals following the injection of serum or vaccine and what advice would you give to avoid such an occurrence ?

A. When an animal is injected with foreign proteins, it develops in its blood serum antibodies against these proteins. A second injection of the same proteins, given after an interval of ten days or more, produces in a proportion of such animals, a condition of hypersensitiveness commonly referred to as anaphylactic shock, which may vary in intensity from a mild indisposition of a brief duration to a severe shock which may result in the death of the animal. This condition not only occurs in animals but is also often seen in man.

It has been shown that cattle usually get sensitized after they have received two injections of the same foreign protein and a third injection may result in the manifestation of anaphylactic symptoms. All our sera for veterinary use are made from buffaloes and the vaccines are prepared using buffalo meat, and as such, cattle receiving two doses of any serum or vaccine may be expected to exhibit such symptoms with consequent danger of death. Fortunately, the proportion of such animals dying is less than one per cent and considering that two injections are necessary to produce sensitization in cattle, the percentage of death due to anaphylaxis that would be expected is negligible indeed.

Unlike animals, in human beings it is possible to detect and pick out, by injecting a small quantity of the product, any person who is likely to react severely and by a process of desensitization anaphylactic shock can be avoided. Moreover, it has not been possible so far to indicate a safe interval between the second and the third injection to eliminate risks of shock as animals remain in a sensitized condition for a very long time.

Until biological products which will not give rise to anaphylactic shock are produced, other means should be adopted for checking the severity of anaphylactic shock. In the meantime, it is advised that injection of adrenaline hydrochloride should be resorted to or, if necessary, the drug may as well be mixed with the vaccine or sera and injected.

FIG. 1. Spraying potato plants with Dithane-D—14, $ZnSO_4$, lime at Chataidhara Sookeapookri, Darjeeling.

FIG. 2. Sprayed potato plants with Dithane-Z—78 at Lodhama, Darjeeling.

PLATE 17

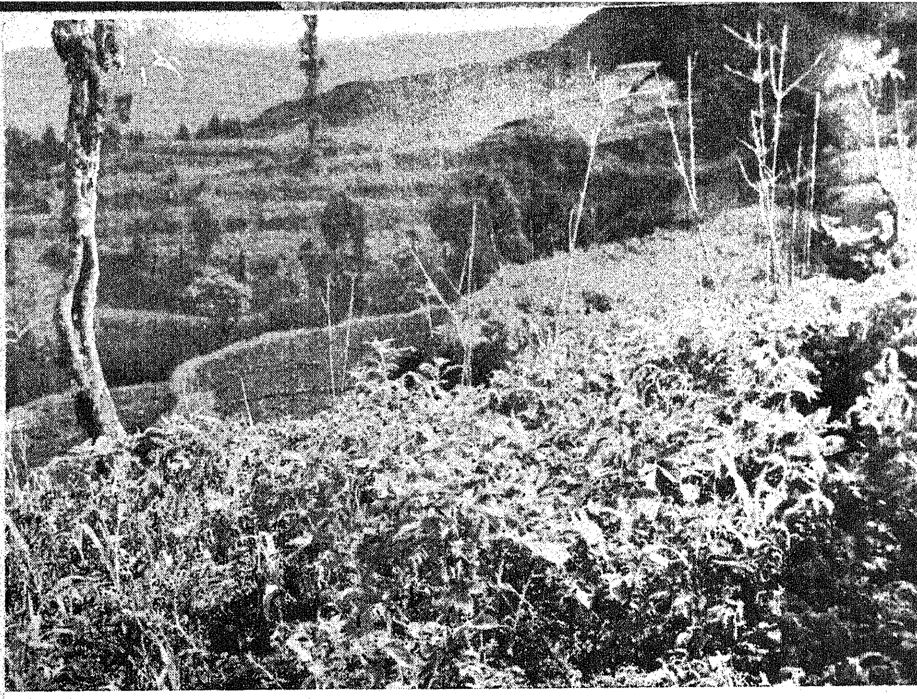
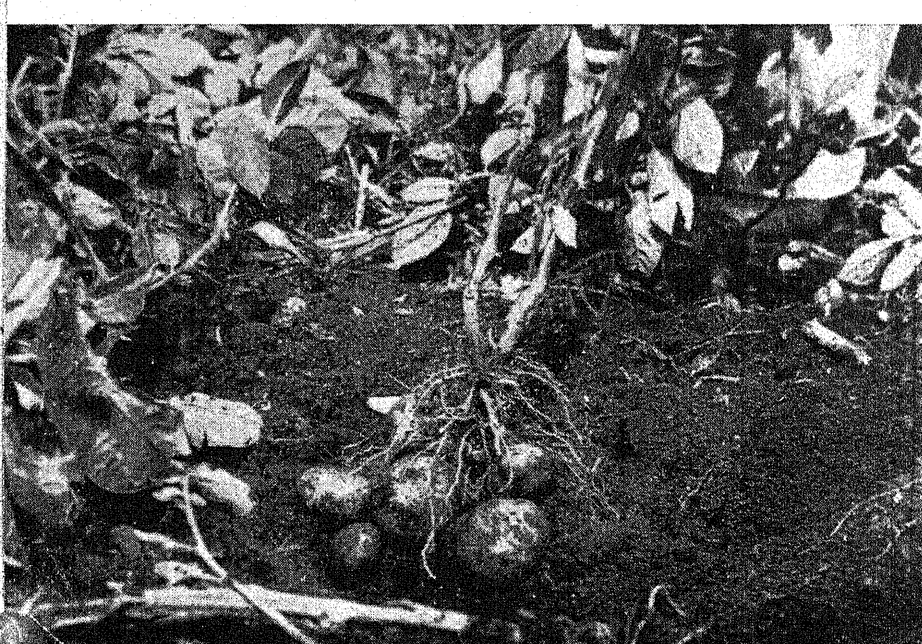


FIG. 3. Sprayed (right) *vs.* unsprayed (left) Sonada, Darjeeling. Spraying done with Perenox.

FIG. 4. Yield of a plant sprayed with Dithane-Z—78 at Lodhama, Darjeeling.



WEST BENGAL

P. S. MAJUMDAR

IN pursuance of the policy of the Government of India to achieve self-sufficiency in food by 1951, we have concentrated all our efforts towards that end. Some of the measures already initiated in that direction are indicated below.

Intensive cultivation centres

The revised schemes for increased food production are being concentrated in selected areas where, on account of the existing irrigation facilities, good normal rainfall, soil fertility, etc. the risk of failure due to adverse climatic conditions is reduced to a minimum. The area thus covered under intensive cultivation comprises of about 280 unions as compared to about 2,000 unions in all in the province.

Distribution of seeds

We have distributed 168 tons of improved paddy seeds and now we have commenced procuring wheat and other *rabi* seeds. Winter vegetable seeds in small packets are now being sold and arrangements are under way for the sale of vegetable seedlings. A considerable portion of these vegetable seeds, e.g. cabbage, cauliflower, tomato, spinach, turnip, etc. have been produced in our Rungbull and Kalimpong farms in the Darjeeling Hills and other farms in the plains.

Seed potatoes

Last year we raised disease-free seed potatoes in our 150-acre Rungbull farm situated in the Darjeeling Hills, which was subsequently multiplied in plains under rigid conditions ensuring elimination of viruses and protection of plants against fungus diseases. About 7,200 md., a portion of potatoes obtained from this crop in plains, have been for the first time, stored in the Brooklyn Cold Storage and Ice plant that we obtained from American Army Disposals. This quantity along with 3,000 md. of seed potatoes obtainable from this year's crop in Rungbull farm, will be distributed in the ensuing potato season.

P. S. MAJUMDAR is Assistant Public Relations Officer, Directorate of Agriculture, West Bengal.

Cultivation of substitute food

Sweet potato vines, sufficient to cover about 2,000 acres, have been raised in 134 nurseries and are being distributed to growers. Ten thousand cassava stems obtained from Travancore have been planted, for multiplication and observation, in cultivators' plots in three districts where the crop is likely to do well.

Fertilizers and manures

Fertilizers and manures are being distributed and our target for the current year is 15,000 tons of ammonium sulphate, 1,500 tons of ammonium phosphate, 8,000 tons of bone meal and 11,000 tons of oilcakes. As compared to our target of 20 tons, we have distributed 22 tons of seeds of green-manuring crops.

Town compost is now being prepared in 23 municipalities and the quantities produced and distributed during the period from April to August 1949, are 6,860 and 1,904 tons respectively. This manure is distributed free, only transport cost being charged ; so also cattle dung of Calcutta *khatals*, 55 tons of which were distributed in July and August 1949.

Calcutta sludge is supplied at different rail and road heads in the province at a

flat rate of Rs. 5 per ton. Only 55 tons were thus distributed in July and August 1949 ; bulk of the distribution will, however, be made in winter.

Village compost to the extent of 51,600 tons were applied in fields out of the last year's stock and 22,500 tons so far produced during the current year. In order to encourage production of compost in villages, two prizes of Rs. 15 and Rs. 10 will be awarded to the best producers in every union subject to a satisfactory performance above a minimum standard. A special prize of Rs. 50 will also be awarded in every union of the intensive cultivation zones. Last year 2,815 prizes amounting to Rs. 35,625 were paid for the production of village compost.

Irrigation

Five small irrigation and drainage schemes like re-excavation of silted-up channels, construction of *bunds*, etc. were executed towards the end of 1948-49. This year 68 such schemes have already been sanctioned and another 62 are under examination. As yet 10 schemes have been executed and the rest will be taken up after the cessation of rains It is expected that altogether 250 schemes will be worked to completion during the year.

Materials for the manufacture of 1,000 dones as also 160 Persian Wheels manufactured last year have been distributed. We have set up a target for the distribution of 150 pumping sets of which 25 have already been purchased and orders have been placed for 75 more.

Wasteland reclamation

This year about 600 acres of wasteland have been reclaimed with tractors in addition to the cultivation of such lands reclaimed last year.

Plant protection

In the Darjeeling Hills, about 1,017 acres of potato crop were given protective spray against the blight disease. Seven hundred acres of this crop were also sprayed for control of insect pests. This resulted in a considerably increased yield. This potato crop in the hills is very important in the sense that this is the only source of internal production of seed potatoes.

About 25,000 md. of paddy seeds were treated with Agrosan GN for control of *Helmenthosporium* For control of paddy pests, about 7,400 acres of paddy crop were given dusting and spraying with various insecticides.

FIG. 5. Yield of a plant sprayed with Perenox at Karmi Estate, Darjeeling.

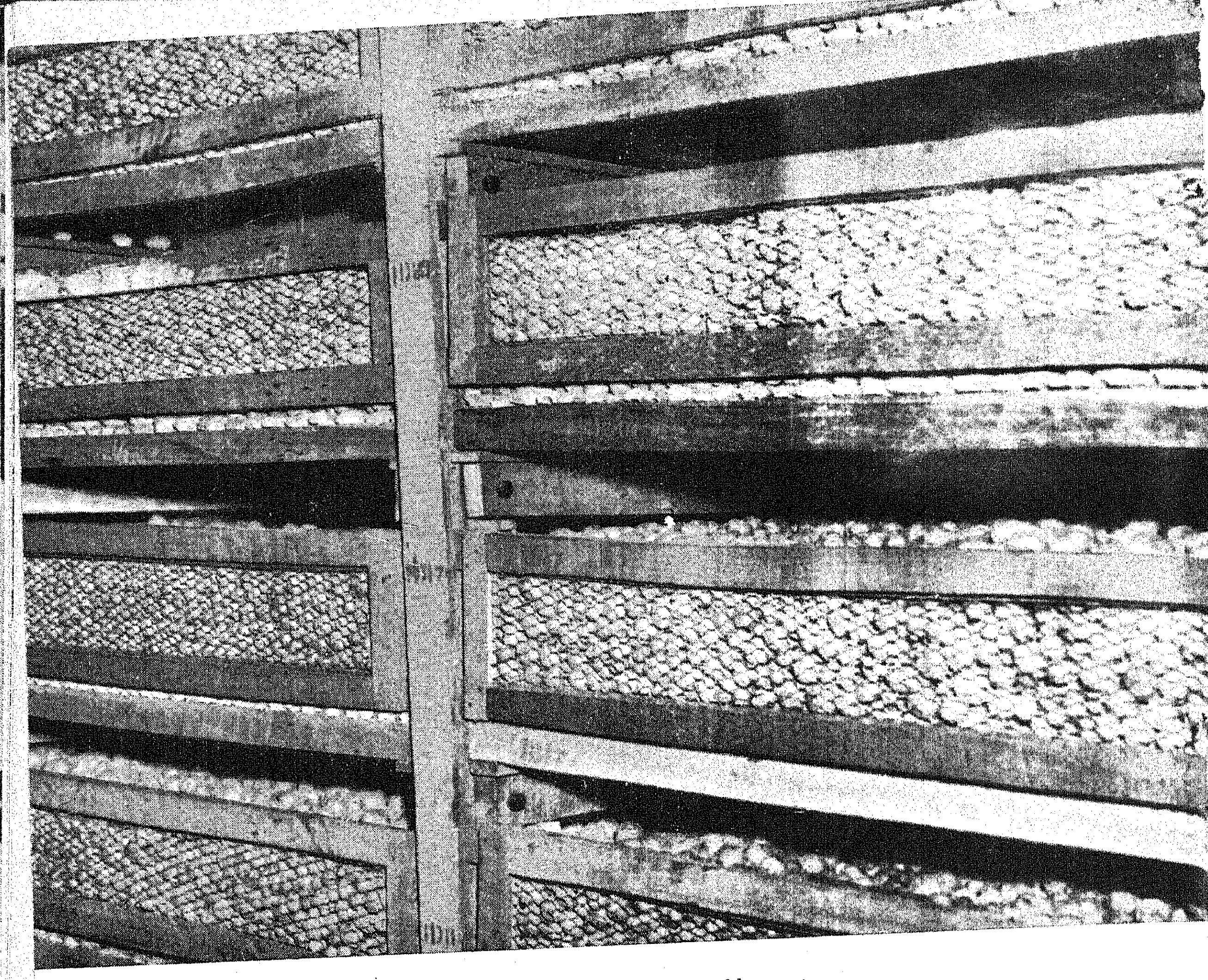


FIG. 6. Seed potatoes kept in cold storage.

FISHERIES DEVELOPMENT NEWS

By BAINI PRASAD

THE Government of West Bengal have initiated a comprehensive programme of fisheries development in the province. Nine schemes have been framed at an estimated total cost of more than Rs. 69 lakhs. It is estimated that nearly nine lakh maunds of fish will be produced up to the end of 1950-51 as a result of the working of these schemes, and that the annual production thereafter will be more than 6¾ lakh maunds. These schemes have been approved by the Government of India, and loans and subsidies for implementing them have already been sanctioned. The schemes include many aspects of fisheries development, such as the setting up of nursery units in rural areas, stocking of tanks, production of shark liver oil, fish-meal, processed fish and utilization of other fishery by-products, exploitation of foreshore and offshore fisheries, development of *beel* fisheries, running of demonstration salt water Bhery fisheries, distribution of capital goods among needy fishermen, setting up of demonstration power craft carrier units and improvement of silted up and dilapidated tanks in dry districts. Some of these schemes were put into operation in 1948-49, and it is expected that the remaining schemes will be implemented in the current year.

Orissa

In addition to a large number of tanks and ponds, there are vast stretches of swampy areas in Orissa. Though extensive piscicultural operations are carried on in the province, so far as tanks and ponds are concerned, very little work has so far been done in regard to swamps. These swamps, which are thickly infested with weeds, are not only unproductive, but are a source of danger to the health of people living in their vicinity. One such swampy area was recently cleared of its vegetation and stocked with fish by a cooperative society of fishermen with very encouraging results. The Orissa Government have now formulated a scheme for developing several other similar areas. The scheme has been approved by the Central Government and it is hoped that the work will start in the near future.

For stocking operations in Orissa, arrangements have been made by the Fisheries Department for the collection of sufficient quantities of spawn of fish from the Mahanadi and other rivers in the province. This spawn is reared to the fry and small fingerling stage in nursery ponds, and then distributed for stocking into departmental and private tanks and ponds. Nearly 20 lakhs of fry were distributed last year, and the target for the current year was fixed at 35 lakhs.

In connection with the rearing and distribution of fry and fingerlings in Orissa, it has been found that the rate of mortality between the spawn and the fry or small fingerling stage is very high. In several areas it has been roughly estimated that out of every thousand spawn put into the nursery ponds, only 30 fry or small fingerlings of economic species survive. If the rate of survival can be increased even to twice of its present figure, fish production in Orissa will be materially increased. In order to find out the factors responsible for such a high rate of mortality and to suggest measures for reducing mortality, a team of workers consisting of fishery zoologists, botanists, chemists and others from the Central Inland Fisheries Research Station, Pulta, has started investigations in Orissa. Though the work will necessarily have to be continued for a year or two, it is confidently hoped that some concrete

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results will be obtained even ih the current fry season.

United State of Travancore and Cochin

There are vast stretches of backwater areas all along the Indian coasts, many of which can be converted into productive fisheries at a comparatively small cost. The area of such waters in Travancore and Cochin is also very extensive. A small backwater area in Cochin has been converted into a fish farm by putting up protective bunds and partitioning it into ponds of manageable size. Fries of mullets, pearl spot and milk fish, which are fairly abundant in the backwaters, are collected at the proper season and transferred into the stocking ponds. Encouraged by the results obtained at this farm, the Government of the United State of Travancore and Cochin Union, in consultation with the Government of India, are proposing to extend these operations. An area of 420 acres has been earmarked in Travancore for this work. This area will be properly bunded and partitioned. Ex-servicemen will be given 10 acres each for paddy-*cum*-fish culture. A salt-resisting and slow-maturing paddy will be grown, and the area will be simultaneously stocked with fry of mullets and other fishes that are abundant in the backwaters. By the time the paddy crop ripens in nine to ten months, the crop of fish will also be ready for harvesting. If the experiment proves successful, as there is every reason to hope, the work can be extended in Travancore and Cochin and possibly in other areas also on a large scale.

Pilot offshore fishing operations of Central Government

In connection with the exploratory off-shore and deep-sea fishing operations started by the Government of India at Bombay, four fishing vessels have been recently acquired. Two of these are Danish Cutters for trawling, and the other two are Reekie boats for ring-net and other types of surface and midwater fishing. The trawlers have started regular fishing operations recently and the Reekie boats are expected to be ready for fishing shortly. While these vessels will bring in substantial quantities of fish as a result of their operations, their main object is to chart the fishing grounds, assess the suitability of different kinds of vessels and gear in our waters and to undertake other types of exploratory work.

Across the Borders

FEAR OF WORLD HUNGER*

By SIR JOHN RUSSELL

IT is currently accepted that the world's population is increasing more rapidly than its power of producing food. The coloured peoples and those of Eastern Europe increase much more rapidly than those in the West. Among the Western nations, it is usually the lower income groups that multiply most quickly. The anticipated result is a progressive deterioration in quality of the populations but an increase in quantity. This part of the forecast must be left to population experts. Only the second part, that the world food production resources are nearing their limit, is dealt with here.

It is, of course, a fact that land capable of or actually producing food is lost to cultivation every year ; also that no large areas of land suitable for settlement by Europeans are now available. Nevertheless, there is still land that could be used, and much of the existing cultivation could be intensified.

Accurate figures are not known, but the world's population is about 2,000 million, and the annual increase about 20 million. The area of land having climate suitable for crop production is about 11,500 million acres—about five acres per head of world population. This, however, includes great tracts of almost impossible soils, while the area actually producing food is of the order of 2,000 or 3,000 million acres—about seven per cent of the total land surface.

The tillage figure is indefinite because of the wide latitude given to the term 'grazing land'. But accepting the data as they stand, the average allocation of cultivated land per head for the world is at present about 1 or $1\frac{1}{2}$ acres per head. In Europe, about 1·5 to 1·8 acres suffice per head of population, and in the vegetarian countries of the East about half this area, or less.

Unequal incidence

It is estimated that some two-thirds of the world's population are food producers, most of them peasants, and all experience shows that the food producer is the last to go hungry when trouble comes. The food problem is, therefore, of unequal incidence ; it presses hardest on the crowded lands, where a large part of the population is either non-agricultural or, if on the land, redundant. The three chief regions are north-west Europe, including Great Britain and Italy, India, and east Asia, including Japan and part of China. Elsewhere the possibilities of food production are still adequate even though they may not be fully used.

The chief food imports of north-west Europe and Italy before the war were cereals and oilseeds, but we needed meat and dairy products also. On the average, continental Europe, before the war, imported from outside its borders 11·1 million tons of grains per year, including 3·7 million tons of bread grains. But we imported no less than 9·75 million tons of grains, of which 5·6 millions were bread grains.

The war upset the very efficient arrangements by which this commerce was carried on, and new ones have been set up. The grain areas of the great wheat-growing countries of Europe, France, Italy and Spain are, or were until recently, still below their pre-war acreage, as also were those of Germany, Hungary, and Rumania. The countries of north-west Europe can no longer rely on supplies from Eastern Europe. They must look to the Americas and Australia,

*From *Agriculture, the Journal of the British Ministry of Agriculture.*

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and now compete with us. Can these countries increase their supplies to satisfy the new demands ?

Wheat acreage

The reports of the Food and Agriculture Organization indicate that the world acreage of wheat, which in most countries had fallen to a minimum in 1943, had by 1946 attained its pre-war value of something over 365 million acres ; but in the meantime, of course, the world population had increased. Argentine and Australia are not yet up to their pre-war areas. Canada has a little more, and the United States still more than pre-war.

This failure to increase the world area of wheat since the 1934-38 period has been interpreted as showing that all the wheat lands of the world are occupied. But there was a similar standstill between 1909 and 1924, when the world acreage remained steady at about 280 million ; thereafter it rose steadily until 1937, when it reached 365 million. The block is probably due to limitations of transport and storage facilities, and until a market seems assured, i.e. until the food is needed, no one is prepared to incur the considerable cost of providing more. For the same reason there has been a similar stagnation in areas under barley, oats, and maize.

Sir William Crookes, in his Presidential address to the British Association in 1898, declared that the wheat areas of the world were almost fully exploited, and after the 1930's the world would begin to suffer hunger unless yields were increased. With true scientific insight, he indicated the way out : the synthetic production of nitrogen fertilizers. This was duly accomplished and has led to a great increase in food production and saved us from hunger during the two wars and after.

Plant breeders' success

But the wheat lands were not exhausted, and indeed they have expanded greatly since his time. Canada, in 1898, had four million acres of wheat ; in 1940 it had 28 million ; and its present acreage is 24 million. Australia in 1898 had under five million, but in 1947 had 14 million acres. This quite unexpected expansion arose from the success of the plant breeders in producing new varieties of wheat better able than the old ones to grow in regions of low rainfall ; in consequence, the wheat zone was pushed more and more into the dry regions, and also into the northern regions of shorter summers.

At first the plant breeders' work was purely empirical and, while much success was achieved, there were difficulties which could not be overcome, especially in regard to rust. The development of modern genetics had greatly strengthened the plant breeders' powers of attacking problems, and after years of research the Minnesota workers, under Professor Stakman, and the Canadian Rust Research workers have now produced varieties more resistant to rust than any before.

It is quite impossible to forecast how far this wheat breeding work can go, but modern science can hardly fail to produce still more drought and disease-resistant varieties suitable for still drier regions, and varieties that can be pushed further northwards. Crossing with *agropyron* (couch grass) is claimed by Tsitsin to do all this, and the claims are being studied in Canada.

Soil conservation

A great difficulty about expansion into the dry regions is the liability to soil erosion ; soil drifting where the rainfall is less than 12 inches per annum, gully erosion when it is more. Undeniably, much land has been lost in this way ; in many cases, however, not beyond hope of recovery. Methods of prevention and cure are known, and the Food and Agriculture Organization reports that the importance of soil conservation is being increasingly realized, though progress is not infrequently retarded by shortage of staff and materials.

In the U.S.A. and in most parts of the British Commonwealth considerable action has been taken ; to a greater or less extent 49 countries are doing something. The 'conservation districts' of the United States, where proper preventive measures are adopted, have increased from 36 million acres in 1938 to 1,112 million acres in 1948, and by nearly two million acres in Puerto Rico. Active conservation plans are in operation on nearly 158 million acres, and the 'treated area' is 83 million acres.

Dr Bennet, Chief of the Soil Conservation Service, in his report for 1948 writes : 'By

sharply increasing our present conservation operations on the land we can overcome and control erosion within 20 or 30 years'. Even in the United States, however, conservation has not yet overtaken deterioration; still less has it done so in other countries. In any case it is a slower process, and action therefore has to be on an adequate scale.

Value of grass

One of the most important agents in conservation and rehabilitation is grass, which is just as valuable in the dry regions of the world as in the wet. As with wheat when it was pushed into the dry regions, so with grass; the first step is to find suitable varieties, then by selection and breeding to improve them. Since these dry regions are used more for grazing than for cropping, it is necessary to find grasses or leguminous plants suitable not only for soil conservation but also for grazing, though, of course soil conservation comes first. Active research on this subject is in progress in the U.S.A., Canada, Australia, New Zealand, South Africa, and elsewhere.

The Soil Conservation Service of the U.S.A. recently surveyed four Western States and found only five per cent was in good condition; on some 70 to 80 per cent of the range, forage production could be doubled with proper conservation practices. Similar results could be widely found elsewhere.

The Australian work on range improvement has been summarized recently by Dr Trumble in his book *Blades of Grass*; but the excellent work of Dr Pole Evans in South Africa is not as well known as it deserves to be. He has searched the dry regions of Africa for drought-resistant grasses and found a number that are good both for grazing and soil conservation. His collection is planted near Pretoria, and it is greatly to be hoped that the necessary breeding and selection work can be carried out. Proper management of the grazing is, of course, essential.

Problems of tropics

The tropics contain large areas of land capable of producing much more food than at present, but they present special and often very difficult problems, not only technical, but human as well.

In the wet tropics, plantation crops—tea, rubber, palm oil, etc.—grown under British or Western European supervision have given considerable knowledge of the scientific and technical problems involved, and shown the need for treating the region as a whole, i.e. putting the permanent crops on the high ground which is subject to leaching and erosion, and the annual crops, such as swamp rice, on the low ground. The proposed UNESCO survey of the forestal regions of the Amazon Valley, if carried out. should show how this vast region could ultimately be utilized.

The African savannah regions of seasonal rainfall are already being developed for oilseeds and other tropical crops, and this work has been helped greatly by the modern insecticides which enable noxious insects, tsetse fly and others, to be controlled. The disc plough and modern large implements have made large-scale operations possible, and though difficulties still remain, they are likely to be more on the human than on the technical side.

At the other end of the climatic scale much progress has been made in this country in utilizing high-lying land that had long been almost waste (though much of it was used in the 19th century), and in Sweden, Finland and Russia in extending the region of cultivation northwards and getting higher output from the podsols. It seems unlikely that all these efforts to expand the present small area of the world's cultivated land will fail.

Need for intensified cultivation

There is, however, greater scope for increased food production by intensifying cultivation of existing land. More than half the world's food producers are working on very primitive methods and obtaining very poor yields. The old medieval grain-fallow system, discarded here in the 18th century, is still widely practised in the peasant countries, with other systems equally inefficient. We doubled our yields when a proper rotation was substituted and livestock husbandry fused with arable husbandry, and further, the way was opened up for greater intensification.

Considerable increases could undoubtedly be obtained by similar methods in the peasant countries. There are, of course, difficulties, both technical and political; they include the

provision of a proper system of land tenure, of education, of buildings, roads, water and farming appliances; particularly some measure of industrialization to take redundant people off the land and set them to produce the appliances the farmer needs.

Before the war Czechoslovakia and Poland had both gone well on the way to do this. In India the experimental farms regularly obtain at least double the neighbouring peasants' yields. Even in our own country the most progressive farmers obtain well above the average output of comparable land. Once a suitable system is devised and responsive varieties of crops and stock found, the biggest advances can be expected from a fuller and better use of fertilizers. Their consumption is greatly increasing, but only a few countries as yet make adequate use of them.

Farm losses

Finally, there are still great losses of crops and animals on the farm, and of produce between the farm and the consumer's table. Various estimates have been made of the losses involved, some little more than intelligent guesses, but others, such as the short life of a milking cow in the herd, are based on ascertained facts. The total is impressive. Fortunately great efforts are now being made to reduce these losses, and the recent addition of biochemistry to the list of sciences aiding agriculture, which has already given us selective weed-killers, tomato-setting hormones, oestrogens, anti-biotics, etc. promises still further achievements.

There is no room for complacency, but certainly none for despair; and with intelligence and hard work the food problem for our generation can be solved. All the same the shrill sensationalism of some of the pessimistic writers will serve a useful purpose if it arouses a widespread determination to keep our own meagre allowance of agricultural land as nearly intact as possible.—(*Released through B.I.S.*)

TWO-WAY TRAFFIC IN INSECTS

AUSTRALIA has made available 2,000 dollars to the Commonwealth Agricultural Bureau in Ottawa to buy flies to combat the greenbug *Nezara Viridula* which is destroying vegetables and fruits in Australia. The flies, *Trichopoda Pennipes*, will be collected in Florida where they are used to control the greenbug, and will be flown to Australia before the end of 1949.

The Commonwealth Agricultural Bureau is a central organization with headquarters in Ottawa and is supported by Australia, Canada, the United Kingdom, New Zealand, South Africa and India in its important work of discovering controls for insect pests of plants. Australia, while importing these flies from Florida is exporting beetles to California to help control a weed there.

This season the Victorian Lands Department has collected 1,000,000 tiny *Chrysomela* beetles, which have been sent by air to California to eradicate 700,000 acres badly infested with the weed, called St. John's Wort in Australia.

The original 1,300 adult *Chrysomela* beetles introduced into Victoria in 1934 from Britain and the south of France to control St. John's Wort in Australia have multiplied to such an extent that during the past four years, 6,000,000 of them have been collected in Victoria for re-distribution in other Australian States.—*Agricultural Newsletter*, Release No. AGN/273.

Home Gleanings

NEED FOR AUGMENTING SUPPLIES OF COTTON IN THE INDIAN UNION

By KALIDAS SAWHNEY

ON the basis of the figures for the four months ending April, 1949, the production of cotton cloth in mills in the Indian Union is running at an average rate of 333 million yards per month (the corresponding monthly average for the calendar year 1948 being 360 million yards). On the assumption that this level of production will be maintained, the total for the calendar year 1949, may be estimated at 3,996 or say 4,000 million yards. In addition, the production of cloth by handlooms may be placed at 1,300 million yards for the whole year, while imports may be taken at 47 million yards (the figure for the year ending 31 March, 1949). The total available supply of cloth would thus amount to 5,347 million yards.

Internal requirements

The minimum internal requirements of the Indian Union (population 346 millions) in respect of cloth may be estimated at 4,844 million yards taking the minimum *per capita* consumption at 14 yards against the peak figure of 18 yards in 1938-39 and the average of 16 yards during the five years ending 1938-39 for undivided India. In this connection it may be mentioned that in 1942-43 (and also in 1946-47) the *per capita* consumption of cloth reached the lowest figure of 12 yards. Exports of cotton piecegoods by sea to foreign countries including Pakistan, during the year ending 31 March, 1949, amounted to 341 million yards. In order to provide for exports at this level after meeting internal requirements, the annual production should be of the order of 5,185 million yards.

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From the figures given above, it will be seen that there is hardly any scope for the curtailment of cloth production, having regard to the need for meeting internal and export requirements at the current level. It may be mentioned here that in the Indo-Pakistan Commercial Agreement of 1948, provision was made for the export of 4,00,000 bales of cloth (one-quarter in the form of yarn) equivalent to about 600 million yards of cloth, whereas only 156 million yards, being the actual exports to Pakistan, have been taken into account. In the recent Indo-Pakistan Trade Agreement of 1949, however, provision has been made for the supply to Pakistan of 1,50,000 bales of cloth and 1,00,000 balès of yarn equivalent to 375 million yards of cloth. The surplus of 162 million yards (being the excess of the figure of supply over that of requirements may be regarded as a reserve to meet increased exports to Pakistan, if necessary, and to provide for exports of cotton piecegoods by land to countries like Afghanistan, Nepal, etc. which have not been taken into account. Having regard to the reported accumulation of stocks of textiles in the country (exact figures not available), there may be some scope for curtailment of production for a temporary period. The desirability or otherwise of taking such a step requires careful examination in view of its likely repercussions on the textile industry in particular and the national economy in general.

Consumption of cotton

The consumption of all cotton by mills in the Indian Union during the eight months

ending April, 1949, amounted to 29·18 lakh bales comprising 22·29, 2·65 and 4·24 lakh bales of Indian, Pakistan and other foreign cottons respectively. At this level, the consumption for the year ending 31 August, 1949, may be expected to be around 43·76 lakh bales, comprising 33·43, 3·97 and 6·36 lakh bales of Indian, Pakistan and other foreign cottons respectively. As regards the supply of 33·43 lakh bales of Indian cotton required by mills, it may be mentioned that according to trade sources, the current season's production of cotton in the Indian Union is estimated at about 20 lakh bales (excluding extra-factory consumption). This figure may probably be realized. The cotton pressings from 1 September, 1948, to 10 June, 1949 amounted to 1,414,000 bales and accordingly the total pressings for the season may be placed at about 17 lakh bales at the outside, while mill receipts of unpressed cotton may be put at 2·5 lakh bales, allowing for the reported increased offtake in the form of loose cotton. The probable crop (excluding extra-factory consumption) might thus be in the neighbourhood of 19·5 lakh bales. Taking the trade figure of 20 lakh bales for the present as the total production in 1948-49, the Indian mills would need to use some 13·5 lakh bales of Indian cotton from the carryover of 11 lakh bales of this cotton with the trade and 11·6 lakh bales with the mills on 31 August, 1949. Out of the carryover of 11 lakh bales with the trade, three lakh bales have to be set off for exports, leaving a balance of eight lakh bales. If the mill consumption of Indian cotton runs at the rate indicated above, there will thus be no carryover of such cotton with the trade on 31 August, 1949, while that with the mills would stand reduced by about 5·5 lakh bales as compared with the stocks on the corresponding date of the previous year. It is, however, likely that this precarious position would be mitigated by reduced consumption of Indian cotton during the last four months of the season so that the total consumption of Indian cotton for the season would be around 30·32 lakh bales instead of 33·4 lakh bales estimated above. If the total consumption of all cottons is maintained at the current level, the short supply of Indian cotton would have to be met by larger imports from Pakistan and other foreign countries. On the other hand, if, as a result of the accumulated stocks of cloth, there is a corresponding reduction in the total consumption of cotton, then additional imports will not be necessary. It may be stated here that the stocks of all cotton held by the mills on 30 April, 1949, totalling 14·26 lakh bales represent nearly four months' consumption at the current level.

Assuming that the total mill consumption of all cotton during the 1948-49 season would be 42·0 lakh bales (against 43·76 lakh bales estimated above on the basis of the current level of consumption), the stocks of cotton with the mills and the trade on 31 August, 1949, would be around 12·2 lakh bales as shown below :—

		In lakhs of bales (1948-49)
Estimated carryover of all cotton on 31 August, 1948	With mills	15·8
	With trade	11·4
		27·2
Estimated crop in Indian Union (including extra-factory consumption)		22·7
Imports from (a) Pakistan ..		4·0
(b) Other countries		6·0
Total available supply		59·9
Deduct estimated exports of short staple cotton		3·0
Deduct estimated mill consumption		42·0
Deduct estimated extra-factory consumption		2·7
		47·7
Estimated carryover with mills and trade on 31 August, 1949 ..		12·2

It will be seen that the total stocks of all cottons on 31 August, 1949, would be as low as 12·2 lakh bales, even less than the quantity carried over by the mills alone on 31 August, 1948. It is also feared that a portion of these stocks being very old may be ordinarily unusable. The position would be much more precarious in 1949-50 as will be seen from the following tentative estimates for that season :

	In lakhs of bales (1949-50)
Estimated carryover of all cottons on 31 August, 1949, with mills and trade	12·2
Estimated crop in Indian Union (including extra-factory consumption)	24·0
Imports from (a) Pakistan ..	4·5*
(b) Other countries	6·0
Total available supply	46·7
Deduct estimated exports of short staple cotton	0·5
Deduct estimated mill consumption	42·0
Deduct estimated extra-factory consumption	2·7
	45·2
Estimated carryover with mills and trade on 31 August, 1950 ..	1·5

Immediate steps

The above estimates show that there would practically, be no stocks with the mills or the trade on 31 August, 1950, if arrivals from Pakistan are lower than assumed above or the crop in India turns out to be lower. Even to ensure that the position on 31 August, 1950, is not worse than that on 31 August, 1949, immediate steps are required to be taken to augment supplies of cotton in the Indian Union by at least 10 lakh bales during 1949-50, the sowing season for which has just commenced. This figure does not provide for exports of more than 50,000 bales and if it is considered that larger exports should be maintained, the deficit to be made good will be still higher. The desired object can be achieved by one or more of three ways, viz. (i) by increasing the internal production of cotton (a) by increasing the area under cotton, and (b) by increasing the yield per acre, (ii) by greater imports from foreign countries, and (iii) by curtailing the mill consumption of cotton. The scope for stepping up production by raising the yield per acre may be considered as very limited, at any rate for the present, in view of the overriding necessity of using all manure for increasing food production. For the same reason extension of the irrigated area under cotton is not also feasible. Thus the production of cotton would have to be increased largely by increasing the area under cotton. The additional production of 10 lakh bales of cotton would mean an increase in the cotton area by four to five million acres. It may be made clear that this increase in acreage cannot be ensured without affecting the food crops position. As, in any case, it is not feasible to step up the cotton area immediately by four to five million acres, all the three methods mentioned above would perhaps have to be tried to meet the anticipated shortage of cotton supplies. Assuming that the first method is adopted to augment supplies to the extent of one lakh bales of cotton, it would be necessary to increase the cotton area by, at least, four to five lakh acres immediately. The other two methods may be tried to meet the balance of the deficit. It is, however, feared that the delayed monsoon in several cotton-growing tracts may have an adverse effect on the coming season's cotton production.

*As per recent agreement between India and Pakistan.

Increasing area under cotton

From the long term aspect, the main scope for increasing the area under cotton without affecting the food crop position may be in the areas where it is proposed to reclaim waste and weed-infested lands or for which irrigation water will be made available from the major irrigation works under construction or contemplation. It may be mentioned that the Government of India have under consideration concrete plans for the reclamation of six million acres of culturable waste and weed-infested lands over a period of eight years. The Central Tractor Organization has already undertaken reclamation operations in the United Provinces, the Central Provinces and Berar, Madhya Bharat, the East Punjab, the Matsya Union and Delhi. Though designed primarily for increasing food production, yet in the cotton tracts a part of such reclaimed land will naturally be sown to cotton in accordance with the prevailing rotational practice. When the full eight-year plan under the reclamation scheme is completed, a million to a million and a half acres of new land are likely to be planted to cotton. Apart from the areas covered by the plan, there are certain other regions

where extension of the cultivated area is possible by individual effort. For example, the Central Provinces Government recently promulgated an Ordinance (No. VI of 1948) whereby it is compulsory for owners of land over 49 and 99 acres to bring under cultivation 10 per cent and 20 per cent, respectively, of the fallow land standing in their name in the revenue records. It is expected that if this Ordinance, which is at present in force for 1948-49 only, is continued, an additional area may be brought under cotton every year in the cotton-growing tracts.

Perennial cotton

Another direction in which the production of cotton may possibly be increased, as a long term measure without affecting the food crop position, is to explore the possibility of cultivating suitable perennial types of cotton on culturable wastelands. In this connection preliminary investigation has been initiated in Dharwar and North Kanara districts of Bombay Province and some districts of Madras. Observations made so far indicate that if perennial cotton of the desired quality can be cultivated on a large scale with success, such cotton would be a good substitute for the much sought after L. S. S. cotton from Pakistan. The perennial cotton plant requires wide spacing and, therefore, permits the growing of food crops in the intervening space between adjacent rows. This is an additional advantage. In the North Kanara district 100,000 acres of paddy land, which are lying fallow at present owing to malaria and cattle trespass, can be used for this purpose. However, extensive further trials have to be carried out before the future possibilities can be definitely indicated or any recommendations can be made for general adoption.

For the provision of additional irrigation facilities multi-purpose irrigation projects costing about 218 crores of rupees are under construction or contemplation in the existing cotton-growing tracts. The additional area that may be ultimately brought under cotton in rotation with other crops, will be about 2·5 to 3 million acres producing about 1 to 1·5 million bales of superior cotton.—Reproduced from *The Indian Cotton Growing Review*, July, 1949.

WASTELAND RECLAIMED

THE following information is available regarding reclamation of wastelands in provinces since the decision to attain self-sufficiency by 1951 was taken.

Province/State	*Wasteland reclaimed (in acres)*
1. Assam	2,506
2. Bihar	19,503
3. Bombay	1,25,000
4. C.P.	33,172
5. Madras	24,341
6. Orissa	1,833
7. East Punjab	6,459
8. West Bengal	5,838 (During 1949-50)
9. U.P.	3,000 (from 1-8-49 up-to-date)
10. Union of Travancore and Cochin	33,900
11. Hyderabad	1,500
12. Saurashtra	7,000
13. Madhya Bharat	60,000
14. Vindhya Pradesh	16,057 (from 1948 up-to-date)
15. P.E.P.S.U.	700
16. Cutch	400
17. Himachal Pradesh	300

—*Food Bulletin* December 19, 1949.

Book Reviews

HANDLOOM WEAVING INDUSTRY IN INDIA 1948: ITS PAST, PRESENT AND FUTURE

By M. P. GANDHI, M.A., F.R.E.S., F.S.S., J.P. (Messrs. Gandhi & Co., Jan Mansion, Sir Ferozshah Mehta Road, Bombay, pp. 80, Rs. 1-8).

THIS monograph on handloom weaving is a third of the series and well nigh promises to be an annual. From its first issue this monograph has been catering to the interests of the handloom weaving industry.

There was a fact finding committee to report to the Government of India on matters relating to the handloom industry. A mass of information was collected by that Committee which was published in a single big volume. Mr. Gandhi has culled valuable material from that and presented it in a concise form for the busy reader. That material is more or less of permanent interest, and features prominently in the present monograph.

Then came into existence the All-India Handloom Board with its two Committees. This Board took much pains over solving the problem of handloom industry and offered certain important recommendations for stabilization through lifting it from its precarious position. But owing to the war and subsequent political changes in the country not much could be done in these directions. A gist of the work done by the above Board finds a place in the present monograph. Lastly, the author has put some concrete suggestions for the improvement of the industry which had a brief spell of prosperity during the exigencies of the war period. But it has again fallen into a distressingly ruinous condition.

According to the figures published in the monograph, this industry even now employs 2·5 million workers as against seven lakhs employed in the textile mills.

The Government of India have just begun to take interest in cottage industries. Economists from other lands, after carrying out investigations in India, have clearly shown that the cottage industries' share in Indian economics is much larger than that of other industries. Yet, at present, there is little hope of the Central Government being able to save the handloom industry, the largest single cottage industry, from the ruinous competition of the mills.

It is a difficult task indeed. There is a cry in India for more war materials, for more aeroplanes, more destroyers and fertilizer factories. The fertilizer factories, the plastics factories and the aviation industries, though civil in peace time, are really war industries. A Government faced, as it is in India, with the problem of meeting the world in its competition of war preparations through large industries, can have little opportunity to save the cottage industries from the crushing competition of the mills, be it textile or any other, which the Government feels bound to foster.

There should be a change in the outlook of the Government of India so that these cottage industries may take their proper places in a society having a non-violent setting. Poor, as India is, there is no reason why the Indian Government should not set apart the textile mills almost wholly for earning Dollars or Sterlings, and get almost all the textiles that India needs from hand-spun yarn woven in handlooms in cottages.

The monograph places materials and statistics systematically, which all thoughtful workers in the cause of real and peaceful industrial uplift of India will find to be of absorbing interest. (S.C.D.G.)

FREEDOM FROM WANT

Edited by E. E. DeTurk for the American Association for the Advancement of Science. Foreword by Norris E. Dodd (FAO.) (*Chronica Botanica*, Vol. 11, No. 4, pp. 207-284, The Chronica Botanica Co., Waltham, Mass, U.S.A., $ 2.00.)

IN his foreword to the symposium, Dr Norris E. Dodd, Director-General, Food and Agriculture Organization of the

United Nations, tells us how President Roosevelt included world-wide 'freedom from want' as one of the great aims of the peace following the last war. In the midst of the war in 1943, he called the Hotsprings Conference on Food and Agriculture which laid the foundation of the FAO which was built late in 1945 with 57 member nations. The FAO endeavours to increase the production of food faster than the world population is increasing. The present rapid growth in world population coupled with steady loss of soil productivity through erosion and bad management, will result in increasing bitter rivalry between the nations of the world for the earth's basic resources. As there can be no lasting peace in a hungry world, the production, distribution and use of food are the vital problems of the hour. While these are difficult to solve, the difficulties are enormously increased by pessimism of a large section of people who believe that the world's productive resources cannot be improved. Dr Dodd says that the authors of this symposium, scientists and economists, have examined the question, 'Can mankind achieve freedom from want', clearly, dispassionately and with scientific detachment and come out with an affirmative answer. He concludes by expressing the hope that scientists would devote themselves more to the great world problems of producing and distributing food and other produce of farms, forests and fisheries.

'Population and food supply' is the subject dealt with by Mr. H. R. Tolley in the first chapter. Science has given us a basis for confidence that enough food of the right kind for all the peoples could be produced. Greater efficiency is needed for producing and distributing food from about four billion acres of land on which world's agriculture rests. The production of food at a faster rate than the increasing population is a complex problem demanding coordinated efforts of various sciences—biological, physical and social.

Millions of peoples in the world do not get sufficient food needed for minimum health. Although the current food crisis is due to shortage of material, transport difficulties, rise in prices, etc. the main long-term cause of inadequate diet and malnutrition is poverty. Only a few nations such as the U.S.A., Canada, Australia, New Zealand, the U.K., Holland, Sweden and Denmark enjoyed comparatively good diets before the war. While the U.S.A. and certain other countries are eating better than before the war, many parts of Europe and Asia get only 60 to 70 per cent of the pre-war level of the calorie intake per person. Nutrition experts consider a *per capita* calorie intake of 2,250 to 2,650 as necessary. Large groups of people in some nations have less than 1,000 calories per person per day. Dependence on cereals and potatoes for 80 to 90 per cent of the caloric requirements would cause mineral and vitamin deficiencies. If 35 to 50 per cent of the calories are derived from high protein animal products there is no likelihood of these deficiencies occurring. It is necessary to provide for an increase in food production by 25 per cent as the world population is estimated to increase to that extent by 1960. Over 90 per cent of the world's food is consumed now in the countries where it is produced. Yet less than one-fourth of all the farmers have taken to the application of techniques of modern science. The gap between the supply and requirement of food could be closed only by technology being available to the producer. In the U.S.A. the total agricultural production has been about a third greater than before the war with about a seventh less man-power being used. This is due to the fact that fertilizer use was nearly doubled and more farmers used insecticides and machinery. The use of hybrid seed corn became eventually universal in the commercially growing areas.

The second paper contributed by Mr. Robert M. Salter deals with ***'World soil and fertilizer resources in relation to food needs'***. According to him science appears to offer a basis of fact for the attainment of 'freedom from want'. The application of results of agricultural research in the U.S.A. was so efficient during the war years, that despite difficulties, production of food crops maintained an unprecedented peak. Food production can be increased through either more intensive and more efficient use of the land now cultivated or through expansion in areas with under-developed soil resources.

Recent experiments on corn culture in the South-East of the United States under

ordinary farm conditions show that corn yields can be more than doubled by a combination of improved practices. The estimates of production possibilities now in the U.S.A. tend to show that by 1950 increases of 31 per cent in corn, 28 in hay, 18 in wheat, 31 in rice, 20 in pea-nuts, 17 in sugar beets, 22 in potatoes and 31 in sweet potatoes can be obtained ; but as the U.S.A. alone cannot feed the hungry world, other countries must also intensify food production. Taking into account yield increases readily attainable in different soil regions of the U.S.A., yield increases in other countries possessing the same soil groups are predicted. Such predictions for three of the world's most populous countries, China, India and the Soviet Union, are presented in Table I. The estimated food supply possible in 1960 as a result of more intensive farming is presented in Table II. On the basis of these estimates, the world food needs in 1960 could be met for sugar and for roots and tubers on existing crop land. The need, for cereals could virtually be met while production of other classes of food fall short of need.

In connection with the second method of increasing production by bringing new lands under cultivation, it may be noted that about 48 per cent of the world's land area covered by snow, ice, mountains, deserts, etc. has no practical possibilities in this direction. In the remaining 52 per cent we can look for areas for expansion of agriculture. At present only 7 to 10 per cent of the total land area is cultivated. In Table III is presented the estimated potential food production by bringing under cultivation 1,300,000,000 acres of new land distributed over the red soils and Podzol regions all over the world. From these estimates it is concluded that world food needs in 1960 could be met for all classes of food except meat, milk, pulses and nuts.

Intensified farming as well as developing new areas, both require greatly increased quantities of fertilizers. Since the nitrogenous fertilizers can be manufactured by fixation of atmospheric nitrogen, world supplies are limited only by the capacity of plants, which has greatly expanded during the last decade. The world needs of phosphate and potash have to be met from natural deposits. A comparison is made in Table IV of the known phosphate and potash supplies with potential needs for meeting world targets. The known world reserves of phosphate would last more than 5,000 years and the known reserves of potash 500 years.

'Crop production potentials in relation to freedom from want' is the theme of the third paper by Mr. K. S. Quisenberry. In the U.S.A. hybrid corn has contributed greatly to increased production. The 1946 corn crop was 217 million bushels larger than the 1920 crop and it was grown on 10 million fewer acres. The wheat production is now 78 per cent more than what it was 50 years ago, the increase being due to earlier varieties which escape destructive effects of hot winds and damage by rust. The newer varieties evolved by breeders and grown by farmers are responsible for increased production amounting to 170 million bushels per year. In the case of oats, development of varieties resistant to stem rust and to smut has increased yields from 31·1 bushels per acre in 1941 to 37·3 bushels in 1945. The average yield of potatoes in the U.S.A. in 1917 was 100 bushels per acre which rose to 139 bushels in 1943 and to 184 in 1946. The factors which contributed to this increase were the new disease-resistant varieties, more efficient disease and insect controls, certified seed and improved fertilizers and culture practices. An outstanding example of improvement in forage crop through plant introduction from Russia is the 'crested wheat grass'. It has established itself successfully as a crop for pasture, hay, and ground cover to prevent wind erosion ; it occupied an area of 3 million acres of grain fields alone in 1944 ; two new bacterial wilt-resistant alfalfa varieties (Buffalo and Ranger) developed by breeders have been found to give 1·69 tons more per acre than the ordinary ones. Varieties of red clover resistant to anthracnose gave increase in yields ranging from $\frac{1}{4}$ to $\frac{3}{4}$ ton per acre. The possibilities of increasing acre yields of rice in countries where food is known to be scarce such as India and China by use of improved varieties, better cultural, fertilizer and irrigation practices are discussed. Assuming a 10 per cent increase as being within the limits of possibility, the increase effected would be 255 million bushels in China and 206 million bushels in India or a total of 461 million bushels annually. On

an average *per capita* consumption of rice at 250 lb. per annum, the increased production could feed 58,086,000 more people.

'***Animal production in an efficient food economy***' has been discussed by Professor F. B. Morrison in the fourth section of the Symposium. Food of animal origin forms only 9 per cent (on dry weight basis) of the total food consumed by the world's population. But it varies from 3 per cent in Asia to 25 per cent in North America and 36 per cent in Oceania (Australia and New Zealand).

The question arises as to whether food of animal origin could possibly be increased throughout the world to the North American level. Milk production easily ranks the first in importance and in efficiency in this production drive. From the energy point of view, pigs would stand second to milk production in efficiency, but considering all factors, the second place should probably be given to egg production. Production of beef and lamb also ranks very high in so far as meat is produced largely from the forage that would otherwise be wasted. A liberal amount of foods of animal origin is desirable in our diet for reasons entirely apart from nutritional considerations. Farm animals are an efficient means of condensing and storing a surplus of food in a period of great plenty. The processing and distribution of animal products provide more employment and industrial development. The increase in milk production can be brought about through breeding of better types and improved forage production without decreasing yield of cereals for human food.

'***The economics of freedom from want***' is the topic of the fifth paper contributed by Professor John D. Black. The final object of all application of economic principles is the use of natural resources and human effort in such a way as to obtain from them the highest level of well-being for mankind. He emphasizes the great need for coordinating technological and social sciences in dealing with actual problems. If this is done, the writer thinks it reasonable to talk about increasing the degree of freedom from want for which the following ways and means have been suggested :

(1) Adjusting the numbers of population so that each family can come closer to its optimum output and accompanying level of living.

(2) Improving the arts and technologies, not only in agricultural production but in the distribution and use of farm products ; not only in agriculture, but in all lines of production and use.

(3) Increasing the productivity of the workers by enabling them to feed themselves better and keep themselves in better health and by educating and training them to increase their skill and efficiency.

(4) Developing the productive resources of a country by land improvements of all kinds, by utilization of water-powers, by better conservation of resources.

(5) Included in the foregoing but probably needing special mention is increasing the amount of capital goods used per worker in the form of power in all its forms, of tools, machinery and equipment of building, of fertilizers, of livestock and feeds, etc.

The preceding papers contributed to the symposium have shown that the possibilities from action suggested on the lines mentioned in 2 to 5 above are such as would more than double the average world output per worker in the next century. If the optima are to be raised, the gains along lines 2 to 5 must be faster than the population increase.

From the simple facts and figures presented by Dr Salter in the second paper, it is argued by Prof. Black that far more vital to the success of the FAO programme is what happens to birth rates and death rates in the next half century, than technological progress in agriculture, or converting new lands into farms. He concludes 'all hope of any progress towards freedom from want for food in the world could be buried in a population avalanche'.

The symposium concludes with the chapter on '***Obligations of science towards freedom from want***' by Mr. M. A. McCall. According to him technological advances for improved crop yields in the U.S.A. fall into three categories, viz. (1) increased mechanization, (2) increased use of lime and fertilizers in conjunction with improvements in soil management, and (3) widespread use of high yielding hybrid corn and superior disease-resistant varieties of various crops. But the writer warns the agricultural scientist of the latent threats for the future. Large yields remove larger amounts of essential soil

nutrients and accelerate depletion of the soil, our primary food producing source.

He is of the opinion that the lag, in use on farms of the best practices of soil management, is primarily due to the failure of scientists to transfer the basic principles of soil and crop science into systems of management, workable on farms under a wide variety of conditions. An instance offering possibilities for better implementation of research is cited in the case of the Alabama Agricultural Experimental Station. A farm has been set up where the findings of the Station as to the best rotation, cropping and soil management practices are worked into a farm plan. This farm with its record of yields, income and costs is in reality a pilot plant operation.

The Test Demonstration Programme of the Tennessee Valley Authority is another plan to carry research results to the farmers of a community in a form that they can transfer to their own farms. A farmer in each community, chosen by his neighbours, enters into an agreement to carry out certain cropping and fertilizer practices, keeping records which are available to the co-operating State College and Agricultural Experiment Station, the Tennessee Valley Authority and his neighbours and permitting his farm to serve as a local demonstration unit. In return for this service he receives the necessary phosphate fertilizer from the Tennessee Valley Authority and advisory help from the Extension Service.

Another system that seems in many ways to offer promise is an individual farm advisory service similar to that provided by the Soil Conservation District or the Farm Home Administration. This plan would provide, in a country or district, for well-trained technicians competent to work with each farmer, desiring the service, in developing a well-rounded farm plant for his farm. (R. S.)

ARMY'S GROW MORE FOOD DRIVE

A TOTAL of 11,92,979 lb. (nearly 14,495 maunds) of foodgrains were saved, due to the troops voluntarily underdrawing their rations, up to December 15, 1949, by the Indian Army since it launched its economy and 'grow more food' campaign four months earlier.

During the first two months, i.e. up to October 15, only 2,15,540 lb. (about 2,619 maunds) were saved, and so the figure of 9,77,439 lb. (about 11,877 maunds) registered for the last two months of the period—more than four and a half times as much—records a marked improvement in the position.

Nearly 8,410 acres of land were put under the plough by the three Commands—Eastern, Southern and Western—up to December 15. This includes 3,008 acres leased by the Military Estates Officer. Besides this, an additional acreage of 3,371 was proposed to be brought under cultivation on the date of completion of the four-month period.

The main crops sown are cereals, besides vegetables and fruits, and the total quantity harvested from these new 'farms' till December 15 was 25,12,618 lb. (about 30,530 maunds).—*Food Bulletin*, January 30, 1950.

News and Views

A VILLAGE COOPERATIVE EFFORT

HOW a little cooperative effort by the villagers can solve many of their day to day difficulties is shown by the building of a small culvert in village Shamaipur, about eight miles from Delhi. Shamaipur is one of the ten villages under the Delhi Villages Development Scheme which is being operated by the Indian Council of Agricultural Research and the Delhi Administration.

For 20 years and more, the single bullock cart track which runs through Shamaipur, has often become impassable through the collection of water, drained from a neighbouring well. The difficulty became more acute during the monsoon, but no solution was found till the visit of the hon. Shri Jairamdas Daulatram, Agriculture Minister, to the village a month ago. When the matter was brought to the notice of the Agriculture Minister, he suggested self-help and cooperative effort. Donations were collected and contributions made. As against an estimated cost of Rs. 700 for making a culvert over which village traffic could pass, it will now cost 50 per cent less, the whole of which has been met by the villagers themselves. Bricks, cement and labour have had to be paid for, but each household has contributed a few hours of work and 100 cubic feet of earth dug by the villagers from wasteland in the village. Completion of the culvert will have solved a problem which for two decades had baffled the villagers. (*P.I.B.*)

IMPROVEMENT IN AGRICULTURAL STATISTICS

'THE whole system of collection of agricultural statistics requires careful planning, greater coordination and proper organization' states the report of the FAO Census Committee which was appointed by the Government of India in April, last year, to work out the details of enquiries in connection with the World Census of Agriculture to be held in 1950-51. The Committee has not restricted the scope of its enquiry to the items presented by FAO, but has suggested methods to place the agricultural statistics of India on a sound basis as a permanent measure. The Chairman of the Committee was Mr. W. R. Natu, Director of Economics and Statistics, Ministry of Agriculture, Government of India.

Out of the total geographical area of 781 million acres of land in India, present agricultural statistics cover only about 557 million acres, as no estimates are available for the remaining 29 per cent of the area. Even the available data is not of the same uniform standard of accuracy and reliability in the different provinces and States. This is mainly due to the differences in the methods of collection of statistics which depend on the system of land revenue in the different provinces.

Defects in agricultural statistics

Pointing out that the need for accurate statistics for agricultural planning is very great today, the Report lists the defects in the existing statistics as follows : (1) gaps in coverage, (2) lack of uniformity in definition and classification, (3) defects of tabulation, (4) defects of the primary reporting agency, (5) defects of supervision and checking, and (6) defects in planning and coordination.

The agricultural statistics of India cannot be said to be complete till estimates of acreage under the principal heads of land utilization and under crops are available in respect of

The hon. Shri Jairamdas Daulatram, Agriculture Minister, inspects a culvert being built by the villagers of Shamaipur through their cooperative efforts.

PLATE 21

The hon. Shri Jairamdas Daulatram at Shamaipur (another view).

PLATE

the entire geographical country, and estimates of agricultural production are obtained for every acre of land cropped.

One of the chief causes of inaccuracies in reporting of the primary agency is the large increase in the work of the village *patwari*. Being the only official in the village he has little time to compile agricultural statistics properly. An important step suggested in the Report to improve agricultural statistics is to reduce the burden of work on the *patwari*. The report also expresses the view that as a result of control over procurement of foodgrains, production and distribution of agricultural commodities, there is a definite incentive for the *patwaris* to report biased estimates.

Improvements suggested

The Report suggests improvements in the collection of statistics relating both to the area and the yield. It recommends a complete enumeration of all the survey numbers for the accurate determination of the statistics of acreage. The method of random sampling, says the Report, is a necessary supplement to complete enumeration but cannot be a substitute.

In areas which are not yet cadastrally surveyed, immediate steps should be taken to initiate such surveys. Pending such surveys suitable reporting agencies should be created.

As regards the statistics of the yield of principal crops which are to be collected annually, the Report recommends crop cutting experiments carried out on fields selected at random. It also emphasizes the need for extending the scope of these surveys to all the crops for which estimates of yield are now prepared, and to all provinces and States including non-reporting areas.

Other technical improvement in the methods of collection of area and yield statistics have also been dealt with in the Report.

Besides the annual area and yield statistics, the Report recommends that data on cultivators' holdings should be collected once in five years.

The Report recommends the use of standard basic forms which will provide all the information contained in the several forms at present in use, but in a correlated manner. This will result in the collection of agricultural statistics on a uniform basis and facilitate the subsequent compilation, consolidation and tabulation at all stages and improve the accuracy of the statistics. Suitable basic and abstract standard forms covering the entire scope of agricultural statistics have been drafted by the Committee and standard definitions of the more important items have been laid down.

Finally the Report discusses in detail the organization necessary in the provinces at different levels and at the centre for the collection of agricultural statistics. It considers it desirable to make a beginning towards building up a non-official crop reporting agency based on the voluntary cooperation of cultivators, traders and other agricultural interests.

In the interest of obtaining reliable data essential for proper planning, the Report recommends early implementation of its recommendations. This would also be of advantage in securing accuracy of world statistics under the proposed agricultural census.

In a separate note, Mr. N. C. Chakravarty has emphasized the importance of multi-purpose sample surveys.

The Committee consisted of Mr. W. R. Natu as the Chairman and the following members : Mr. N. C. Chakravarty, Government of West Bengal ; Mr. K. Kishen, Government of U.P. ; Mr. H. C. Kothari, Government of Jaipur, Mr. N. T. Mathew, Government of India ; Dr B. Natarajan, Government of Madras ; Dr V. G. Panse, Government of Indore ; Mr. G. M. Sankpal, Government of Bombay ; Mr. S. M. Seth, Government of C. P. and Berar ; Dr P. V. Sukhatme, Indian Council of Agricultural Research and Mr. J. S. Sharma (Secretary). (*P.I.B.*)

BASELLA RUBRA: A CLIMBING LEAFY VEGETABLE

By V. K. KOGEKAR

THE problem before everybody nowadays is to grow more food by undertaking the cultivation of food and vegetable crops wherever possible. There are some plants whose produce can be used for human consumption, but these have not been fully utilized. *Basella rubra,* known in Poona as *velbondi* or *mayalu,* is one such vegetable. It belongs to the family Chenopodiaceæ and grows in all kinds of soils and is a profuse yielder. It can be grown in compounds of houses and does not require much space as it is a climber. It grows luxuriantly and spreads on roofs and fences when trained by attaching a slender rope or a string. It produces an abundant growth of leaves which can be plucked and used as vegetable. It is a hardy plant and continues living under adverse conditions ; when manured and watered, it exhibits vigorous and rapid growth. It produces seeds in great profusion and these as they fall and remain in the ground, germinate in due course on getting sufficient moisture and thus new seedlings are produced in abundance.

V. K. KOGEKAR belonged to Bombay Provincial Agricultural Service.

In short this vegetable, which is not known widely like other vegetables belonging to the family Chenopodiaceæ, will be of great use to all. Being a climber it does not require much space and those who have very limited space in their compounds can grow one or two plants of this vegetable ; by tying a string to the young plant it may be made to climb up and spread on the roof or some such place that is available.

Leafy vegetables, as we know, contain minerals and vitamins and so form an important item of our daily diet. Taking into consideration the question of space and the qualities of the plant, every householder should try to grow this vegetable, as thereby he will be able to get vegetable for himself and will also be able to add his humble quota to the 'grow more food' campaign.

COVER ILLUSTRATION

RANCHI RICE GROWERS

by

N. S. Bisht

INDIAN FARMING

FEBRUARY, 1950

Vol. XI

No. 2

SUGARCANE AND SUGAR INDUSTRIES*

IT gives me great pleasure to welcome you to this the 12th meeting of the Indian Central Sugarcane Committee and to express my sincere thanks for the trouble you have all taken to come over here from all parts of India. On account of my indisposition, I regret, I was not able to preside over this Committee and the other sub-committees, and I am grateful to the Vice-President for taking the chair in my absence. I am also grateful to him and the members of the various sub-committees for the hard work they have done and their useful recommendations which would considerably lighten our work today.

It is my pleasant duty also to welcome in our midst Messrs. D. D. Puri, A. G. Bandigowda, B. N. Gupta, B. C. Phukan, Dr K. Subbaraju and Raja Raghavendra Pratap Singh who have replaced our retired members and also Messrs. Kidwai and Reddi, Dr R. N. Gowda, Swami Sahajanand Saraswati and Mr. J. S. Agarwal, who have again joined the Committee and Messrs. Kesho Gupta and K. P. Roy who have been freshly nominated. I am sure you would like me to thank the outgoing members for the good work they have done during their tenure and welcome the incoming members. I am sure, the Committee will be greatly benefited by their help, co-operation and advice.

The country is in the grip of a grave economic crisis and the food position as well as the positions of sugarcane, cotton and jute are passing through precarious phases. Unlike cotton and jute which have been adversely affected by partition, sugarcane has not been handicapped by the loss of any appreciable acreage or production and hence it should not present the same difficulties in these respects that are being encountered by the other two cash crops. Careful and proper planning and honest and concerted efforts of all concerned to provide the wherewithals necessary, coupled with the harnessing of the forces of Nature and exploiting the resources of Science, are bound to result in larger production of cane and sugar in the Indian Union. This would also lead to self-sufficiency and the ultimate diversion of some cane area to food and other essential crops.

Since we last met at Walchandnagar in February, 1949, the sugarcane and sugar industries in this country have been faced with many serious problems. The protection which was granted to the sugar industry from 1931-32 has now been extended by the Indian Parliament only up to 31 March, 1950. Various views are held by different interests as to the desirability or otherwise of further extension of the existing tariff walls. The Indian Tariff Board is now busy making, *inter alia* a comprehensive survey of whether further extension is actually needed or not, and if so, to what extent.

Due to various factors, the production of cane and sugar during the 1948-49 season fell short of our expectations. The fixation of remunerative prices of cane and economic prices of sugar has been receiving our attention as well as that of other interests.

About 10·01 lakh tons of sugar was produced in 1948-49 against 10·75 lakh tons in the previous year, showing a decline of about 6·9 per cent. The recovery of sugar, however, had slightly improved being 9·97

* Opening speech of Sardar Datar Singh, Vice-Chairman, Indian Council of Agricultural Research, and Additional Secretary, Ministry of Agriculture, at the 12th meeting of the Indian Central Sugarcane Committee held at New Delhi on 11 and 12 November, 1949.

per cent in 1948-49 as against 9·85 per cent in 1947-48. The quantity of sugar in stock with factories, excluding that in the market, was estimated at about two lakh tons on 1 December, 1948. It was expected that with this large carry over and with the production of the season there would be sufficient sugar to meet the entire demand throughout the year, but the crisis precipitated during the last three months has unfortunately hit the consumer hard as the price of sugar has soared up in an unprecedented way. This crisis has entailed untold misery to the consumer. Taking advantage of a difficult situation, interested parties have created a scarcity and a scare. It is our firm desire that such anti-social and anti-national activities of the profiteers in respect of an essential commodity are rooted out.

Sugar plays a vital part in all programmes of our social or cultural life and it is time for us to consider whether we are or we are not going to adopt an expansionist policy, commensurate with the needs of the consumer and the developing cane and sugar industries. There is undoubtedly an imminent need to raise the standard of production of both cane and sugar and to arrange for equitable methods of their distribution. Adequate targets for the production of sugar have already been fixed but sufficient progress in securing these is still lacking and careful economic planning seems essential. We all must agree that planning in its true sense needs to look a little further ahead than the day after. The twin evils of under-production and maldistribution appear to me to be the basic causes of sugar shortage in India today.

Our schemes for research and development of the sugarcane and sugar industries should be interacting and complementary. The need for this is urgent. The state of affairs today demands vigorous and positive action by the Government, the growers, and the industrialists alike in order to step up production. Failure to do this would result in compulsory imports of sugar which would ultimately result in the premature killing of the sugar industry and also in a colossal loss of income to the growers of cane, which is the only cash crop in many parts of India. It will also lead to the draining out of crores of rupees from our National wealth which we cannot afford to do at present. It would also cause a serious dislocation in the whole of our agricultural and industrial economy.

Our 5-year Development Schemes have been initiated in most of the provinces and the Secretary of the Committee and the Director of the Indian Institute of Sugar Technology were recently sent around the various provinces to see how these schemes were working. The lack of proper irrigation facilities and adequate quantities of fertilizers appears to be the main limiting factor. The respective Governments, therefore, should take immediate steps to improve these facilities and I am moving the Central Government to see what help they can render in arranging to procure larger supplies of sulphate of ammonia and superphosphate for our development work.

The need for stepping up the production of cane and sugar for reducing the price of sugar and for the setting up of a central and well-organized agency for equitable distribution of sugar is imminent and demands serious and considered attention of all concerned. The Sugarcane Technical Committee set up by the Ministry of Agriculture is inquiring into the cost of production of cane in different parts of the country, reviewing the progress of cane research and development and is expected to suggest ways and means to achieve quicker results in increasing the yield of cane per acre and sugar content of the cane to ultimately reduce the cost of production of sugar.

The decision of the Government to bring down the prices of essential commodities necessitates the lowering of prices of sugar and *gur* as well. Though the legitimate demand of the consumer is to reduce the price of sugar on world parity basis, it has not been possible this year for the Government of India to reduce the price of sugar to any appreciable extent, due to economic reasons and the prevailing high cost of production of cane and sugar. The Government of India have decided to fix the statutory maximum *ex*-factory price of Rs. 28-8 per maund for E-27 grade sugar for the ensuing season as against Rs. 29-5 for the same grade for the last season. This price is based on a minimum cane price in the United Provinces of Rs. 1-10 per

maund which is the same as in the last season. The Central Government have also under consideration a proposal for giving inducement to the factories to increase their production in the coming season. They have also decided to give during the following year priority for materials and other facilities to factories which show increased production in the ensuing season. As regards controls over factory stock and their distribution to the different Administrations by the Government of India, existing arrangements would continue, pending fuller consideration of alternative arrangements.

A new feature of the present meeting is the functioning of the Standing Scientific Sub-Committee consisting of experts who have critically scrutinized all the annual progress reports and technical programmes of the current sugarcane schemes and have submitted their recommendations for the consideration of the Agricultural Research Sub-Committee and the General Body.

One of the main causes of the postponement of the date of this meeting from August to November is the non-receipt of the annual progress reports, etc. in proper time. I would again request the sponsors of all the schemes financed by this Committee to submit these reports, etc. in future by the middle of July every year to enable the office as well as the Committee to do full justice to them and also to enable us to hold this half-yearly meeting in scheduled time. The number of reminders that have to be issued to the Central, Provincial or State Governments calling for these reports and other information is increasing very rapidly and is entailing heavy work on the office.

Due to the present financial stringency of the Central Government, it is feared that the annual grant to this Committee may not be increased, and consequently some curtailment in our present expenditure will have to be made. We are expected to review our financial position and to restrict our expenditure to only such items as are urgent and inescapable. Keeping these facts in view we should examine very carefully our extension proposals and the new schemes, etc. The Government of India are scrutinizing each and every proposal very critically and granting each item the priority it actually deserves. Heavy liabilities have, therefore, to be scrupulously avoided as far as possible and ways and means have to be found to keep our expenditure down to the barest minimum. We shall have to be cautious in forwarding our recommendations only for essential items and thus cooperate to help the National Government to tide over its present monetary difficulties and embarrassments.

The Central Sugarcane Research Stations in the United Provinces and Bihar have now been put on a permanent footing by the Provincial Governments concerned. In view of the heavy cane cess that these two Provinces are levying and in view of the allocation of large profits accruing from the freezing of sugar stocks in 1947, it is for consideration whether the annual contributions made by the Committee to these two major provinces for their sugarcane research schemes and which amount to about Rs. 1·22 lakhs to the United Provinces and Rs. 1·18 lakhs to Bihar per annum should continue on the present basis. The Finance Ministry of the Government of India have already suggested that the Committee should discontinue to finance all the agricultural schemes running in the various provinces and to advise the Provincial Governments to meet the expenditure involved either from their own funds or from their respective shares of the profits accrued from the frozen stocks of sugar mentioned above. We have not agreed to the suggestion for the present and the final decision of the Government in this matter is still awaited.

As you have a very heavy agenda, I would not like to recapitulate all the problems with which we are faced, but I would like to emphasize once again that we must try to find satisfactory solutions of the distribution and marketing problems of sugar and *gur*, as otherwise our best efforts to increase the production of cane will result only in the disappointment and loss of our poor growers and the frustration of the hopes and sugar requirements of millions of consumers in this country.

Original Articles

FEATURES OF RICE WORK IN JAPAN AND HOW THEY DIFFER FROM THOSE IN INDIA

By K. RAMIAH and MOTI V. VACHHANI

RICE is the most important single crop in Japan, occupying 7·8 million acres which is 53 per cent of the total annual cultivated area of 15 million acres. The total production of rice is 10·4 million tons giving an average yield of 2,350 lb. (shelled rice) per acre. Due to the importance of rice in national economy, great attention was given to rice improvement by the Government with the result that during the last 60 years, the area under rice had increased by about 25 per cent while the acre yields during the corresponding period increased by about 70 per cent. Thus the total production increased from 4·9 million tons during 1880 to 10·4 million tons during 1942, i.e. an increase of 113 per cent. It is due to the higher acre yields of rice and other crops that Japan is able to produce about 80 to 85 per cent of its food requirements for its population of 78 millions from the annual cultivated area of 15 million acres. The cultivated land of Japan consists mostly of coastal plains and narrow river valleys extending up into mountains. The diluvium is usually sandy and sterile, uplands are leached and soils developed on volcanic parent material consisting of acidic lavas and ash are infertile. Thus the soils are generally poor in natural fertility, and soil fertility is apparently thus not a factor for higher acre yields. The high levels of productions have been attained and are maintained mostly by the application of results of research in practical farming.

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It may be useful to consider the organization of crop research and extension service, which combined with the disciplined and progressive ideology of the cultivating classes and the high percentage of literacy in the country are responsible for such phenomenal results.

The whole country is divided into 46 agricultural districts known as prefectures, each of about 500 square miles. There is a central experimental station at each prefecture and there are 250 technicians for each prefecture or roughly one for each village. This works out to a technical man available to advise for every two to three square miles. These technicians who are either agricultural graduates or sufficiently trained hands maintain the liaison between the farmers and the experimental stations, passing the results of research to the farmers, and bringing to the notice of the research stations the problems of the farmers for investigation. Besides, the agricultural departments of the six Imperial Universities, the Imperial primary, secondary and tertiary branch stations carry out research on specific crops for different ecological regions and pass on the results and the improved varieties to prefectural stations, who after further testing, multiply the seeds on primary seed propagation farms and the cooperative branch stations under the management of the people in the villages. Due to extensive research and extension service organization with a number of small research stations spread all over the country, manned by a large number of technicians, direct contact with the cultivators is possible and the dissemination of results of research to farmers is made easy.

Rice growing conditions in Japan

Despite the recent urbanization and industrialization, Japan is still a nation of farmers with 43 per cent of households engaged in farming. About 5·4 million farm households are engaged in tilling an area of 15 million acres which works out to about 2·6 acre holding per family. Thus the average holding is very small and the cultivator and his family pay personal attention to cropping, treating it more as a garden than a field. Because of the north latitude, temperature is low, and rice cultivation is confined to the period April to October.

Japan could be divided into four agricultural divisions from the standpoint of rice crop. The extreme south districts take two successive harvests of rice per year. The central Japan can be divided in two regions, the southern region growing one rice and one dry crop and the northern region raising one crop of rice only. The extreme north, due to its low summer temperatures, is not suitable for rice. Sixty per cent of the rice fields are left fallow during winter. When two successive crops of rice are taken, the farmer uses an early variety for the first crop and a late variety for the second crop. The first crop is sown in nursery bed in late March, transplanted a month later and harvested by early August. The second crop is sown in nursery beds in July and transplanted after the first crop is harvested. The yield of the second crop is about 60 to 70 per cent of the first crop.

In general the rice varieties grown in Japan belong to the class *O. sativa* forma *japonica* which usually possess short and stiff straw and have short and coarse grain. The rice crop is classified as paddy rice (low land rice) and upland rice. The former occupies about 95 per cent of the rice area and is transplanted and irrigated, while the latter is sown broadcast without irrigation. Attempts are being made to see if direct sowing in lines could replace transplanting.

A brief account of the achievements of research in breeding of improved varieties, in cultural practices and in the use of fertilizers are given below.

Breeding of improved varieties of rice

The rice breeding in Japan is carried on according to the traditional methods of selection, introduction and hybridization. The basic sciences, especially genetics, cytology and plant pathology, have played an important role in developing the improved varieties. Of late much attention is being paid to genetico—ecological approach to plant breeding. By this is meant the determination of the reaction of varieties to specific climatic, edaphic and biotic environmental factors.

Rice breeding work in Japan was started as early as 1893 when the Ministry of Agriculture and Forestry established the Imperial Agricultural Experiment Station in Tokyo and its six branch stations in different districts. They collected 4,000 native rice varieties from all over the country which were carefully examined for various characteristics and yielding capacity. Several superior varieties were thus isolated which became popular and their cultivation extended to wide areas. The pure line selection method was first used in 1910 and because of its simple technique and effective results, the method was adopted on the prefectural and branch stations. This method was very successful and by the year 1922, 490 new strains for various parts of the country were isolated.

Hybridization or cross breeding for rice improvement was first used in 1904 for combining in a single strain the desirable characters of high yield, disease resistance and cold resistance. Certain varieties which were resistant to the most important rice disease of Japan, caused by *Piricularia oryzae*, were used in the hybridization programme. Up to 1925, 50 new varieties had been developed by this method.

As already mentioned, the hybridization since 1926 has been remodelled and the new method is mostly based on the genetico-ecological conceptions. For this purpose, the whole country has been divided into ten main ecological districts based chiefly on climatic, soil and biotic factors, each having a local rice research station, called a secondary breeding station. Under this scheme, the whole set-up of rice breeding consists of seven primary breeding stations under the control of the Imperial Government, where the programme of breeding, choosing of parents, making the crosses and growing and study of F_1 and F_2 progenies

are carried out. The selected F_3 progenies from these stations are distributed to secondary stations, where the behaviour of the F_3 progenies and later generations are studied and the selections made in accordance with the local requirements. These selections are subjected to preliminary trials for yield and resistance to diseases. When the superiority of these varieties is established, they are sent to prefectural stations for final tests and if the results are confirmed, the variety is given a *Norin* number and is taken to seed farms for multiplication and distribution. By this method 16 new *Norin* varieties have been evolved which are widely cultivated.

The success of the rice breeding programme can be gauged by the fact that 69 per cent of the area under rice is grown under improved varieties, 46 per cent under the varieties developed by hybridization and 23 per cent under the varieties developed by pure line selection. According to the estimates of rice experts, the increase in yield of the line selections based on the average of 261 strains was about 9 per cent, whereas the increase in yield of 20 varieties developed by hybridization was about 16 per cent.

Improved cultural practices

Use of good disease-free seeds : The cultivators are conscious of the advantages of the improved varieties and renew their seeds very frequently and often every year, which is made possible due to the existence of a large number of agricultural cooperatives, one in each village. The cultivator usually gives his own produce to the cooperatives in exchange for the improved seed he gets.

In order to get assured and uniform germination, the seed is sifted through a sieve and then put in salt water solution to float out the light seeds. The seed is treated against fungoid diseases mostly with the mercuric compounds before sowing.

Nursery and field practices : Ninety per cent of the rice crop is transplanted and great importance is attached to healthy and vigorous seedlings for transplanting. The nursery area is well-prepared and laid out in rectangular beds with raised side bunds and having a width of $3\frac{1}{2}$ ft. to 4 ft. and length according to requirements. The seed beds are invariably manured with organic and inorganic manures before sowing. Mostly sprouted seeds are sown either by hand or by special drilling machine which deposits five seeds in each hole. Frequent weeding is done to keep the seed beds free of weeds and the spraying of the seed beds with fungicides and hand picking of egg masses of insects is a very common practice. In the northern districts where the temperature at planting time is low, hot beds are used to get quicker and satisfactory germination.

The holdings in Japan being small, the land is mostly prepared with hand tools and some time with implements driven by animal power. The Japanese cultivator is very disciplined and hard working and promptly carries out the recommendations of the technicians. The main operations of paddy field consist of dry ploughing and puddling, irrigation, making bunds and levelling. Liberal doses of both organic and inorganic manures are applied at the time of preparation of land and after transplanting, the details of which are given elsewhere. The transplanting is done mostly in June and July at distance of 9 in. $\times$ 9 in. with 4-5 seedlings per hole. The crop is usually irrigated and 4-5 weedings are given either with hand or with implements, the latter being possible only in fields where the distance between rows is wider. Weeding is considered a very necessary practice, the first weeding being given a fortnight after transplanting, and subsequent ones at an interval of 10 to 15 days.

Harvesting and preparation of the produce : The rice crop is cut close to the ground with sickle as in India. Threshing is either performed by human labour or motor power. Japan has made much progress in designing small power-operated machines for threshing, winnowing and hulling operations. Power threshers are operated by 3-5 h.p. gasoline engines or by electric motors, all operations being performed at the same time. Motor threshers are community-owned and are commonly used by the farmers in the village community.

Application of fertilizers

As stated already the soil of Japan are rather low in fertility and can supply only about two-thirds of the important plant food ingredients necessary to produce a

good rice crop. Thus various methods are practised, which are standardised as a result of extensive manurial trials conducted in the country.

Manuring of nursery beds : Complete fertilizers are applied to the nursery before sowing and thoroughly mixed with the soil. On an average, about 5 to 6 lb. of N and 3 to 4 lb. of each of P_2O_5 and K_2O are applied to a seed bed area of 1/25th of an acre which is sufficient to transplant about an acre of paddy field. Wood ashes are applied when the seedlings are about 1 in. in height.

Manuring of paddy fields : From experiments it has been found that application of complete fertilizers gives the best results. Based upon the properties of the soil, the average amount of the main plant food ingredients applied is 80-100 lb. of nitrogen and 70-80 lb. of each of phosphoric acid and potash per acre. They always use the combination of organic and mineral fertilizers.

As regards organic manures there obtains the practice of growing a green manure crop, mainly of soya bean, which is cut and ploughed under about three weeks before transplanting. The amount of green matter thus added varies from three to five tons per acre. The field is then irrigated and often about ½ ton of lime per acre is applied to promote decomposition of the green manure ploughed in. Besides green manure other organic manures like soya bean cake, night soil and composts made from farm wastes are also extensively used. The organic manures are applied to the land before ploughing.

The most effective method and time of application of concentrated manures have been determined from the standpoint of rice physiology. As a result of these investigations two-thirds of the quantity of the ammonium sulphate and phosphate and potash is applied in the dry condition just before puddling and the remaining one-third is applied in two later applications, one about three to four weeks after transplanting, and the other two to three weeks before ears emerge. This is supposed to prevent ammonia escaping as gas from the soil and improve the effectiveness of nitrogen. Ammonium sulphate is the common nitrogenous manure applied, of which about one million tons were produced in Japan before the war. During the war due to the non-availability of enough quantities of this fertilizer, the yields are said to have come down.

According to the Japanese investigations the use of commercial fertilizers and better varieties are dependent upon each other. That is to say, the improved varieties produced in recent years are better only when heavily fertilized and also improved varieties must be grown if the full benefits of fertilizers are to be expected.

The question of water facilities in Japan as compared to what obtains in India may also be considered. Irrigation facilities in Japan are only afforded to the paddy crop and 90 per cent of the crop is irrigated. It is stated that at the time of sowing and transplanting there is always plenty of water available. The sowing and transplanting are carried out expeditiously within a short period during which the assured water is available. There may be difficulty of obtaining water in the later period but this is not considered as serious as scarcity in the earlier stages, as it is known that early and timely planting contributes more to satisfactory yields. In India the failure of early monsoons delays the planting and ultimately affects the yield adversely and even in canal-irrigated tracts, there is always insufficiency of water in the beginning to get through the planting expeditiously. In fact the canal supplies as in parts of Orissa become plentiful only when the monsoon has set in strongly and there is not very much need for the canal water at that stage.

Rice being the master crop and the characteristic food of the entire population of Japan, the yields have been raised by skilful cultivation, fertilization and scientific seed development. To sum up the main features responsible for higher acre yields can be said to be :

(i) use of improved seeds,
(ii) intensive fertilization,
(iii) assured supply of irrigation water for the crop,
(iv) control of diseases,
(v) the large number of technicians available for giving advice to the farmers,
(vi) the high percentage of literacy among the people,

(vii) the large number of agricultural cooperatives, and

(viii) the personal attention each cultivator pays to rice cultivation, treating it more as a garden than a field crop.

We can now compare the position of India with that of Japan.

Improved seed

The work of breeding improved varieties is well-advanced in India and in several of the provinces there are improved varieties available suited to the different tracts. The testing of these improved varieties is however not thorough in some of the provinces. This might have to be undertaken immediately so that the areas suited to the different improved varieties could be delimited before an intensive seed distribution organization could be set up. There is also great scope for intensifying breeding in some areas to obtain varieties not only with higher yields but also with improved ancillary characters.

The dearth of sufficient technical personnel will however be an obstacle to overcome particularly in Bengal, Bihar and Orissa. We shall also require many more experimental stations than what we have. Though there has been considerable improvement in seed multiplication and distribution organization in recent years, we will still be behind Japan for a long time to come before the ideal condition of each village having a seed area to meet the requirements of the village every year could be reached. It is mainly through the agricultural cooperatives which exist in each village that Japan has reached this ideal condition.

Intensive manuring

This is a more fruitful source of improving production than even improved seed, and in fact in Japanese agriculture the two always go together to get the maximum benefit. Experience in Madras has always shown that this is the ideal thing to do. The comparative low price of foodgrains was however a great obstacle against cultivators taking up intensive manuring practices with the result that the best out of the improved varieties could not be realized. Things have however changed and people have become fertilizer conscious, but unfortunately sufficient quantities of fertilizers are not available. The present position is not likely to improve in the very near future. Since the war Japan is also suffering for want of sufficient quantities of fertilizers. The only course left open to us is to exploit other sources. Oilcakes, bone-meal, composts and green manuring can be thought of. Of these, quantities available of the first are not unlimited and it would be more economical to use them in limited quantities in conjunction with the last two. In fact green manuring has proved the best and cheapest form of fertilizing rice crop everywhere, and there is no doubt that all our efforts at present should be concentrated on popularizing green manuring wherever it can be done. Applying small quantities of fertilizers along with composts or green manure should be the best form of manuring rice.

Although experimental data on manuring practices are not available in India on the scale existing in Japan, we have sufficient information to go on with for the next few years until more critical data as applicable to small individual areas could be obtained. It has to be remembered that the quantities of manurial ingredients, namely nitrogen and phosphoric acid, applied in Japan are roughly three to four times those which we are recommending in India in the 'grow more food' campaign. Experimental evidence available does show that these quantities can be safely increased to twice or even three times the present level only in certain tracts of India. The use of night soil, both raw and composted, is very common in Japan whereas it is almost completely wasted in India.

Cultural practices

While transplanting is the universal practice in Japan, in parts of India direct broadcasting still obtains even where facilities for transplanting do exist. How this can be changed needs immediate consideration. Transplanting will be the only way of keeping down weeds which are mainly responsible for lower yields in broadcast fields. Holdings in Japan being small as in India there are not any improved practices of preparing the land which obtain in Japan and which can be usefully copied here.

Small improved tools are however used in Japan for threshing, shelling of grain, polishing, etc. and there appears to be definite scope for such improved implements in India too. In fact in Japan all the preparation of the land is done by hand and cattle are used only where the size of the holding is more than three acres. It has to be admitted that the small Indian rice farmer does not put in so much of hard labour in the field as his Japanese opposite does.

Extension service

It is here we find the greatest difference between Japan and India. While we are not far behind Japan in the availability of technical information, it is in the application of such information in actual cultivation practice that India has to learn from Japan. The organization and the strength of personnel is very different in the two countries. That Japan has a technician for every two or three square miles is something which India cannot hope for even after several years. Even in Indian provinces where there is an agricultural demonstrator for each *taluqa*, there is not much personal contact between him and the farmers. Things have become even worse in recent years as most of the demonstrators' time is taken up in the business aspects of selling seeds, manures, iron, etc.

REFERENCES

1. Leonard, W. H. Rice as a crop in Japan. *Jour. Amer. Soc. Agron.* **40** : 7 : 579-602, 1948.
2. Morinaga, T. Improvement in rice culture in Japan. (*Unpublished note by the Director, Imperial Agricultural Experiment Station, Tokyo, Japan made available to the senior author.*
3. Ramiah, K. Important features of rice cultivation in Japan. (*Unpublished note based on the discussions of the senior author with rice technicians present at the International Rice Commission of the FAO at Bangkok.*
4. Salmon, S. C. Crop improvement in Japan. *Jour. Amer. Soc. Agron.* **40** : 11 : 1017-1035, 1948.

SCIENCE INCREASES BANANA, PAPAYA CROPS

IRRIGATION and scientific treatment of trees and soil have resulted in yields of 400 cases of bananas and 500 cases of papaya to the acre on the Duranbah Research Station, on the north coast of New South Wales, Australia. In Australia, bananas are marketed in cases containing 1-1/3 bushels (75 lb.) and papayas in tropical cases containing 1 bushel.

Duranbah Research Station was established a few years ago ; land, plant and manual labour is provided by the Banana Growers' Federation ; scientific staff is supplied by the Division of Horticulture of the New South Wales Department of Agriculture.

On the recommendation of horticultural officers, an irrigation plant was installed at the station two years ago. The following season, the yield per acre for bananas grown on the station was 400 cases, against the New South Wales State average of 90 cases to the acre. This year, banana growers who followed the station's irrigation plan cut up to 500 cases on commercial plantations.

Valuable work with papayas has also been done on the station. Careful selection of seed, attention to orchard hygiene and irrigation have combined to produce up to 500 cases of papayas to the acre, which is more than double the acreage output of the average papaya plantation in the district.—*Agricultural Newsletter*, No. AGN/280.

PROPER CONSERVATION OF SEEDGRAINS*

PROPER storage of seedgrains is of vital importance in any scheme of food production. Seedgrain has to be stored for at least six months and sometimes surplus grain may have to be carried over for another season or so. Generally it is stored by the cultivator in his crude indigenous receptacles. In some cases specially constructed bins or stores are being used for seed conservation by the State Departments of Agriculture.

Insects responsible for the damage to stored grain are always fond of attacking the 'germ point' of the grain. Therefore, the first injury resulting from the insect attack is the destruction of the plant embryo, rendering the germ completely useless for seed purposes. It is, therefore, essential that seedgrains should be properly preserved and saved from insect attack. Methods by which this can be achieved are outlined in this note.

Storage accommodation

Cool, dry and sound seedgrains do not permit insect development. The most satisfactory receptacle for storing seedgrains is a properly built *pucca* bin. Bins built of cement concrete or brick masonry with waterproof plaster are satisfactory structures. A bin 10 ft. × 10 ft. × 8 ft. in size with a man-hole at the top and a spout near the bottom is a satisfactory economic unit for storage of about 5,000 maunds of grain.

Where facilities for the construction of bulk bins are not available and the seedgrain has to be stored in bags, the latter must be kept in *pucca* stores. The walls, floors and ceilings of the stores should be properly plastered as far as possible to a smooth finish. The doors, windows, ventilators should be tight-fitting and should open outside. Tin sheeting should be nailed on to both sides of the bottom 6 in. portion of the doors to prevent entry of rats. The plinth should be about a foot high. In areas where high humidity prevails, the plinth should be at least three feet and walls should have an additional coating of cement mixed with 'pudlo'* to make them waterproof.

For small quantities of grain cement concrete bins of 20 to 50 maunds capacity, with tight-fitting lids are the best. For still smaller quantities earthenware *matkas* or metal bins (kerosene tins with lids) may be used.

Preventive measures

The following precautions will be found useful to prevent seedgrain from getting moist and attacked by insects :

(i) The crop should be promptly harvested. This will decrease chances of the grain getting infested in the field. Seedgrain should be allowed to cool before storage.

(ii) It is highly desirable that the seedgrains meant for storage should be absolutely clean and dry. It can be properly dried (moisture content reduced to less than 10 per cent) by exposing it in thin layers for three or four hours to the sun before placing it in storage.

(iii) Before storing grain, it should be ensured that the bin or store is clean, dry and uninfested. It should have no cracks or crevices. Rat holes, if any, must be filled and closed with cement or sand mixed with pieces of glass. In the case of bagged grain it should also be seen that bags are properly stacked, leaving 1½ to 2 ft. alleyways between each stack and the walls to allow free ventilation. About one-fifth of the space between the top layer of bags and the ceiling should be allowed. Proper dunnage such as timber battons or *ballies* should be laid below each stack.

(iv) Safety of the seedgrain against insect, etc. can be further ensured by mixing the seedgrain with any of the chemically active dusts given below in order of their merit. (1) DDT. (10 per cent) at the rate of 1 part for 10,000 parts[1].

* By the Plant Protection Adviser to the Government of India, New Delhi.

* Available from M/s. Martin-Burn & Co., Connaught Circus, New Delhi.

[1] DDT dust is available from M/s. Geigy Insecticides Ltd., Neville House, Bombay.

(2) Benzene hexachloride (4 per cent) at the rate of 1 part per 10,000 parts[2].
(3) Pyrethrum dust with talc or chalk at the rate of 1 part per 20,000 parts[3].
(4) Nepthalene crystals at the rate of 10 parts per 10,000 parts[4].

DDT or benzene hexachloride do not affect viability of the seed ; nepthalene does not injure the germinating power of the seed having a moisture content below 10 per cent. Magnesium oxide has also been found effective in preserving seedgrain at the rate of 4 lb. per 1 000 lb[5]. *Seedgrain treated with either of these chemicals should not be used for human consumption or for animal feed.*

Measures for disinfesting seedgrains

If, despite the above precautions, insect infestation is discovered, the seedgrain should be fumigated with ethylene dichloride or carbon tetrachloride at the rate of 30 lb. per 1,000 maunds of grain. The fumigant destroys insect life without affecting the germinating power of the seed. The method of fumigation is simple. The grain in a bin can be fumigated by pouring over it the liquid fumigant and sealing the bin airtight. It should be opened after 36 hours and then exposed to air. Bagged grain can either be fumigated in an air-tight room or under tarpaulin ; the latter can provide reasonable airtight conditions. As far as possible, tarpaulin should be gas-proof but, in the absence of such a material, water-proof tarpaulins can be used with almost satisfactory results. A stack should be covered over with tarpaulin weighting it down at the base of the stack. At the top two or three bags may be placed edgewise to create an empty space for proper diffusion of the gas.

Further information on this subject may be obtained from the Directorate of Plant Protection, Quarantine and Storage, Ministry of Agriculture, Government of India, New Delhi.

[2] BHC is available from M/s. Imperial Chemical Industries (India) Ltd., or M/s. Nourey & Van de Lee Ltd., 517, Taj Mahal Hotel, Apollo Bunder, Bombay.

[3] Pyrethrum dust is available from M/s. Bombay Chemicals Ltd., 129, Mahatma Gandhi Road, Bombay.

[4] Nepthalene crystals are available from M/s. Imperial Chemical Industries (India) Ltd.

[5] Magnesium oxide is available from M/s. Magnestic Syndicate Ltd., Salem Jn. P. O., South India.

USEFUL SPAN OF LIFE OF THE FOWL IN INDIA

By S. G. IYER and S. NARAYANAN

IN commercial poultry farms where economic production is the prime concern layers are seldom kept for table eggs during the second and subsequent years. The common practice is to retain a third of the pullets after the first year of laying for a year more and sell the remaining birds for table. Unfortunately, this procedure will not enable the poultry-keeper to test his birds for their breeding worth.

Rice[1] *et al* working in the Cornell University, analyzed the production records of 1,434 birds over a period of years and observed that careful selection would pay to keep some best hens for commercial production for two or even three years. The number of individuals represented in the averages from the third or fourth year onwards was meagre. Such a practice on the whole was useful for the maintenance of vigour and livability among the flock. In the ordinary circumstances, says Jull[2], the decline in egg production from year to year is about 20 per cent of the preceding year's production and relatively greater decline in the second year has been experienced in the case of very heavy laying pullets.

Poultry-keepers in India are anxious to know the utility life of the domestic fowl in the tropics and an answer to this being an impending necessity, this note has been prepared.

Age and egg production

The hatching season at Izatnagar in the Uttar Pradesh, extends from November to March when the replacement stocks are usually produced. All the chickens hatched were wing-banded and pedigree records carefully maintained. Routine vaccinations against Fowl-pox and Ranikhet disease were carried out between 8 and 12 weeks of age. The general health of the stock was satisfactory during all stages of growth. At the completion of 24 weeks pullets were selected, transferred to the layer houses and trapnested for one full year with a view to calculate the total annual egg production of individual birds. In the following September, or at the end of the first year of laying, regular culling on the basis of the first year performance was carried out and the selected breeders were mated to sires of known pedigree. No changes in the strain of the three breeds—White Leghorn, Rhode Island Red and the improved indigenous (*Desi*) pullets—were made during the experimental period (1944-48) in order to avoid any possibility of getting variable results by the introduction of fresh blood.

All the birds were fed on balanced layer's ration from maturity onwards. They suffered little or no parasitic infestations. Selected hens were utilized as breeders for three or four years to perpetuate not only the factor for livability among the progeny but also the potentiality for long-term production. The total number of birds maintained for this purpose was small but it could not be helped as the birds had to be culled at all stages so as to remove the boarders ; only such of those birds which have survived the strain of production and the environment for longer periods have been considered for the collection of data. Thus, individual birds were trapnested as accurately as possible from the date of first egg until the death of the bird or as otherwise stated. Their production records in successive years have been calculated and the decline in egg production with age in the three breeds is given in Table I.

S. G. IYER and S. NARAYANAN belong to the Poultry Research Section, Indian Veterinary Research Institute, Izatnagar.

1 Rice, J. E., Marble, G. O., and Hall, D. B. (1930) *Judging Poultry for production*, John Wiley & Sons, N.Y.

2 Jull, M. A. (1928). *Poultry Science*, 7, 226-36.

TABLE I

Egg production in the first and subsequent years

White Leghorn				Rhode Island Red				Improved indigenous (*Desi*) fowl			
Bird No.	Number of eggs			Bird No.	Number of eggs			Bird No.	Number of eggs		
	First year	Second year	Third year		First year	Second year	Third year		First year	Second year	Third year
264	163	140	57	29	183	151	44	64	187	157	66
701	156	116	100	40	263	181	137	74	182	161	116
77	155	91	46	520	142	78	70	79	130	115	73
				590	145	111	32	99	176	49	68
				120	189	134	79	172	148	138	91
								161	176	120	89
								162	144	112	12
Average egg production for the breed	158	115·7	67·7		184·4	131	72·4		163·3	121·6	73·6
Percentage of decline on the production of the previous year		26·8	41·5		..	28·9	44·7		..	25·5	40·7

Table I shows a definite reduction in the egg production from year to year. Individual birds showed wide variations in the annual decline. Birds that laid well in the first year were inclined to lay better in the second and in some cases third year also. One bird laid more eggs during the third year than in the second. Extremely heavy production in the pullet year was followed by a relatively greater fall in the subsequent years whereas the decline in the case of low producers was relatively less. The greatest decline was noticed in the case of Rhodes in the second year while the indigenous (*Desi*) fowls showed the least decline. The decrease in the third year was exceptionally high in all the three breeds and did not compare favourably with the western standards of 20 per cent annual decline, the influence of environment being obvious. About 45 per cent decline was noticed in the case of Rhodes as compared with the other two breeds. The improved indigenous fowl has behaved just as the light breed in the matter of annual decline in egg production.

Average economic life

The production in the second year in general was quite satisfactory and in several instances the retention of layers for a full period of two years from the date of the first egg was justified, the birds paying for their maintenance. The average economic life of a hen in India, therefore, seems to be two years though individuals may lay well in the third year also rendering them most efficient breeders.

Though long-term producers are but few, this character can be well-established in a flock by selective breeding over many generations. Commercial producers who

as a rule do not trapnest their birds will be well-advised to retain all the high persistent producers towards the close of the first laying year and thus avoid the concomitant cost of raising new pullets. The inheritance of the ability to lay eggs over a period of years is therefore of tremendous economic importance. Despite the poor fertility combined with low egg production in the oldest stock, the egg size is definitely larger and the chickens hatched have been found to be far superior in respect of vigour and long utility life, whereas the pullet progeny in the long run is likely to suffer from lowered vigour as well as shortened span of life unless proper selection is made. The cockerel for the breeding pens should come from the oldest hens in the flock. As progeny testing depends upon long life together with persistent production it is preferable to use an old but vigorous hen that had proved her worth to transmit desirable qualities to her offspring. By such a practice constitutional vigour and high laying potentialities with little or no chick mortality can be well-established.

INSULATING WOOL FROM ARECA NUT HUSK

INVESTIGATIONS carried out in the Forest Research Institute, Dehra Dun, have proved that areca nut husk can, by a simple process, be coverted into insulating wool as well as hard boards, which compare favourably with foreign products. The processes of preparation are described in Indian Forest Leaflet No. 112 just published.

About 5,000 tons of areca nut husk available in the country at present go to waste. The leaflet points out that by a simple process of beating the husk with a wooden mallet, it can be converted into satisfactory insulating wool.

By a process of defibration or hydrolysis with weak acid or alkali, the husk can also be used for the manufacture of hard boards. Further experiments are required for improving the moisture absorption and swelling properties of boards made from the husk.

FARM MECHANIZATION

By ROLAND C. HEATH

AFTER every war, small and large industries, who have prior to that war or during it derived their income from other sources start up all over the world and name themselves as Agricultural Engineers or Implement Manufacturers. After the last war, Britain and America saw the farmer being used very much like a laboratory guinea-pig. To the civil engineering industry, farm implements and their manufacture seem extremely simple but few survive much to the sorrow of the purchaser. The agricultural industry, from the engineering point of view, just as much as the farmer himself, is a very exacting one, particularly due to the lack of previous formulae to guide the designer and the fact that it is impossible or nearly impossible to design agricultural machinery on the drawing board, especially in the case of ground engaging equipment. Manufacturers who have been in the agricultural manufacturing business for many years would tell you that they consider it takes atleast four years to develop a new implement or machine and the normal procedure in their approach is to produce a prototype, take it into the field and remove or add during field investigation until they are satisfied that the unit carries out the operations for which it was designed. Then a number of prototypes to the final design are built and tests, over several seasons, in various areas, under varying conditions, are carried out. When the degree of efficiency and mechanical reliability have been established, only then it is put on the drawing board and production commenced.

Farm mechanization

Farm mechanization throughout the world is still in its infancy. In India to date it has not even been scratched. The approximate estimate of world requirements can be visualized when it is considered that there are still in use somewhere in the region of 250 million draft animals—horses, mules, oxen, bullocks, camels, etc. Because a farmer removes from the yoke his bullocks and attaches a motorized unit, even in its broadest sense, one could not justify the statement that he is mechanized. The words 'farm mechanization' are used extremely loosely today and the purchase of tractor power without serious consideration of the suitability of the unit for the particular operations on the farmer's property often increases the cost of production rather than decrease it. All tractors have their limitations, some have wider limits than others. Farm mechanization in its truest sense can only be considered on the basis that each operation, which was previously undertaken by animal power, is being carried out by mechanical power cheaper, quicker and better. A farmer, who purely leaves his draft animals in the field to watch the tractor do their job, is not in any way assisting his pocket or his country. He cannot, however, be blamed for the safety measure he takes, but he should be blamed for purchasing a unit in which he has not sufficient faith so as to do away with his draft animals, either due to lack of knowledge of its mechanical mysteries or usage.

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Different approach

In a country, in which the introduction of farm mechanization must be slow, where the farmer is, generally speaking, working with tools extremely old fashioned in design and where his agricultural engineering knowledge is nil, a far different approach to the problem must be considered. At first, it should be considered, I believe, at Government level. No agricultural dealer should be allowed to import mechanical equipment without a Government licence. That licence should only be granted provided the minimum standard laid down by the Government is strictly adhered to. Secondly, there should be in a country such as this an Agricultural Advisory Organization, equivalent to the National Agricultural Advisory Council in England, situated in various areas throughout the country, to give advice and lectures to farmers on the advantages of the correct

approach to 'farm mechanization'. Going back to the question of an Agricultural Dealer's Licence, the minimum requirements should be :

(a) The technical staff thoroughly trained by the manufacturers, whom they are representing, should be available at all times to service the equipment and a certificate to this effect should be issued to the implement dealer. The responsibility of ensuring that adequate service is carried out should be binding on the manufacturer, the penalty for failure being stoppage of further imports from the company.

(b) The trained technician of the implement dealer should deliver the unit to the farmer, instruct the operator and, when the purchaser is confident that his operator is efficient in working the equipment, obtain his statement to this effect. Before any import be allowed or at least any deliveries made, adequate spares stock in the territory in which the unit is to operate should be in store and this should be subject to inspection.

(c) And lastly a minimum of six months' free service should be insisted on and, if possible, the purchaser should be encouraged to enter into a contract at reasonable charges for monthly service during the life of the machinery.

Unless these things are done, mechanization on the farm in this country may be more of hindrance than of help in the immediate future to increase productivity of food. There is no doubt that potential market for all types of agricultural machinery is enormous but bringing them to general use must be considered as a long term policy. And those companies, who have been and are still selling machinery or any particular tractors without substantial spares behind them and efficient service after sales, are probably doing more harm to the farming community than any other single commercial activity in this country today. The adoption of 'farm mechanization' in India must be a slow process but if introduced properly, many smaller farmers with small financial resources, who have taken sufficient interest in the possibilities of farm mechanization, would be prepared to risk their limited capital or even borrow if they were certain of service after sales.

A word of warning

A word of warning therefore be uttered to any implement dealer or would-be implement dealer, who has entertained or is entertaining the idea of making a large profit quickly, that his very exacting and very strenuous profession must be taken up as a long term policy, in which for the first five to seven years he should be prepared to make only a slight profit, if at all, if he is going to contribute his fair share to development of agriculture in this country and build for himself a permanent organization.

The Government can do a lot towards achieving this end and failure to take an active interest in the minimum requirements of an agricultural dealer's organization could be a very serious set-back to India.

POLLINATION AND FRUIT SETTING IN *PARWAL* (*TRICHOSANTHES DIOCA* ROXB.)

By G. N. PATHAK and R. N. SINGH

PARWAL fruits are well-known for their use as vegetables, particularly for convalescents. All parts of the fruits are used medicinally.

Prerequisites for pollination

Male and female flowers are borne on separate plants. Generally two flower buds arise from the axil of a leaf in the male plants and only one or both may develop. Similarly two flower buds arise in the leaf-axil of female plants at different intervals and usually the floral bud emerging first develops into a complete flower.

The flowers are characterized by the presence of slender processes on the margin of the petals. The male flowers possess three stamens consisting of three filaments with three fused anthers. This number of stamens is attained by reduction from the initial five by fusion of four in twos leaving only one free.

For opening, the flowers require from the time of their appearance in leaf-axils as buds, 8 to 12 days in the case of females and 13 to 16 days in the case of male ones. The dehiscence of anthers and opening of flowers take place in the early hours of the night. The female flowers always start opening earlier than the males, the time taken for full opening being $1\frac{1}{2}$ to $2\frac{1}{2}$ hours with the former and $\frac{1}{2}$ to 2 hours with the latter. Temperature play an important role in these processes.

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The pollen grains are small and round with three weak spots. It seems they remain viable up to 48 hours. The stigmas remain receptive up to 36 hours but the maximum percentage of fruit setting was obtained only during the first 12 hours.

Pollination and fruit setting

In common practice *parwal* is cultivated by vegetative propagation through cuttings taken from the female plants only. The male plants, which arise from seeds, are commonly neither required nor their presence tolerated because as soon as they are spotted they are destroyed serving no useful purpose. In these circumstances an investigation was undertaken with a view to find out how fruit setting took place.

An examination of the stigma at the proper stage revealed the presence of numerous germinating pollen grains. This proved beyond doubt that pollination did usually take place. The results of an investigation carried out in connection with pollination and fruit-setting are given in Table I.

TABLE I

Pollination and fruit setting

Particulars	Number of flowers under observation	Number of fruits set	Percentage of fruits set	Remarks
I Hand-pollinated ..	125	120	96	Observations were made on different dates in the months of July and August when the plants were in full bloom.
II Setting in naturally opened flower :				
(a) Sown intermingled with male plant ..	137	106	77·37	
(b) Absence of male plant in close vicinity ..	266	92	34·58	
(c) Flowers bagged before opening	150	..		

An examination of the data presented in Table I reveals the following points :

1. Pollination is necessary for fruit setting.
2. Fruit setting percentage in the case of hand-pollinated flowers exceeded those of naturally pollinated ones.
3. Setting percentage is more when the male and female plants are grown close together.

Pollinating agents

Because of the presence of the male and female flowers on separate plants, cross-pollination is the rule. The next step was to find out the pollinating agencies. Since the flowers open at night at about 9 p.m., observations were carried on throughout the night hours but no insect of any importance could at first be seen. However, close observation revealed the presence of some small ants and brownish beetles which could be seen on the flowers right from the time of opening up to about four or five hours before they happened to be closed or shed closure or appeared. These insects have a great liking for the nectar and pollen contained abundantly in the male flowers. These tiny beetles could be seen deep into the calyx cup, crawling from the top down to the bottom through the three smooth apertures made by the three staminal filaments, in the search of sugary secretion and sweet pollen. At first these were neglected as being of little consequence as pollinating agents on the assumption that they could not possibly carry the pollen from a distantly situated male plant to a female flower. But by giving a jerk with a slight tap on the calyx cup, they were seen flying in wind and disappearing. This fact led to the belief that these could be the only probable insects that might be responsible for carrying out pollination. These small beetles (*Carpophylus demidiatus*) were seen invariably in all the healthy male and female flowers and the number of such insects reached as high as ninety in a single flower. Their number decreased with the decrease in nectar and pollen of the flowers which seem to be much relished by these beetles. As they visit both the male and female flowers in large number, pollen grains sticking to the ventral parts of their body as well as the mouth parts get easily transferred to the stigmatic surfaces of the female flowers to which they are attracted by the profuse sugary secretion oozing out of the stigma.

In order to confirm their pollinating nature, female flowers, frequently visited by these insects, were collected from the different localities of Kanpur and their stigmas were examined under the microscope for pollen grains and pollen tubes. It was found that the stigmatic surfaces of such flowers were laden with pollen grains the number of which differed in different flowers, perhaps on account of the frequency of visit by these beetles. Some pollen grains were seen to have lost their contents due to the growth of their pollen tubes inside the stylar canal in the earlier part of night, while others were found as such or just initiating their pollen tubes. This variation in pollen germination on the stigmatic surfaces of female flowers must be due to the successive visits of these beetles.

Small ants (*Componotus compressus*) are also responsible for pollination to a certain extent but only when the male and female plants are close together. It may be noted that *Apis florea* and *Aulocophora* sp. have also a minor role in pollination but their visits are few and far between.

FODDER CATCH CROPS IN THE PUNJAB*

IN the irrigated tracts of the Punjab or in regions where there is enough rainfall, farmers take advantage of the interval between the two main cropping seasons, *kharif* and *rabi*, and grow suitable fodder crops of short duration. This does not in any way interfere with or decrease the acreage under important food or cash crops. By growing cash or food crops and catch fodders in suitable order it is possible to maintain soil fertility. This system of cropping also enables the cultivator to distribute his labour more evenly throughout the year and obtain better returns on his capital ; at the same time it provides palatable and nutritious fodder for his livestock.

Most of the common crops which are grown in the province greatly exhaust the soil. The inclusion of suitable legumes as catch crops between the main cropping seasons is very helpful in preserving soil fertility.

The following fodder crops serve as good catch crops :

Legumes, viz. *guara* (*Cyamopsis psoraloides*), cowpea (*Vigna unguiculata*), *moth* (*Phaseolus aconitifolius*), and non-legume, viz. maize (*Zea mays*), *sawank* (*Echinochloa colonum*) in summer, and other legumes like *senji* (*Malilotus parviflora*), *methi* (*Trigonella foenum-graceum*), and some times berseem (*Trifolium alexandrinum*), in winter are grown with success as catch crop fodders.

These may be grown successfully and with advantage in some of the popular rotations mentioned below :

1. Wheat—*Guara*—Wheat—*Toria*—Cotton
   Cowpeas
   Moth
2. Wheat or Maize—*Senji*—Sugarcane
3. Maize—*Senji*—Cotton, Maize—Berseem—Cotton
4. Maize—*Senji*—Sugarcane—*Methi*—Cotton

Guara

Guara is an important crop grown both for fodder and grain on medium to light soils especially under conditions of shortage of moisture. As a catch crop, however, it is grown for green manuring too. Sown in May-June *guara* is ready for early fodder or for burying in as green manure in about 2½ months, after which *rabi* crops are sown. Thus it fits well in the rotation of cash crops.

Cowpea

Cowpea alone, or in mixture with maize, provides a highly nutritious green fodder in a short period of about 60 to 70 days. Sown towards the end of May or in early June, the crop is ready for harvesting in early August. Thus it is grown as a catch crop in the rotation of cash crops with great advantage.

Moth

Like *guara* and cowpea *moth* also can serve as a catch crop in the rotation of cash crops during summer. It is also generally grown mixed with other crops like cotton and *bajra*.

Sawank

Sawank is a quick maturing fodder crop of about 40 days duration sown as catch crop to provide green fodder in the early *kharif* season.

Methi

As a catch crop it is sown in December-January after sugarcane or after *jowar* for seed, and is ready within 2 to 2½ months. Though the yield is not very high, it serves as a good fodder in areas where due to shortage of adequate moisture berseem cannot be grown.

Senji

Senji is often sown in standing cotton or maize at the end of September or early October. It thus benefits from late watering of these crops. When sown in maize, which is heavily manured, it is considered as a good preparation for the succeeding sugar-cane crop.

*By the Fodder Botanist, Sirsa.

Berseem

It may be grown like *senji* in standing water in maize or cotton and may be ploughed in April, to allow the sowing of the succeeding *kharif* crop of cotton, *jowar* or any fodder.

Generally farmers do not put all their cultivated area under one rotation ; rather it is not possible for them to do so as the area under *kharif* crops is always less as compared to the area under *rabi* crops. These catch crops are, therefore, raised in different cropping systems.

RUST-RESISTANT WHEAT VARIETIES EVOLVED

SEVERAL new varieties of wheat resistant to rust, a disease which is responsible for a considerable loss in the yield of the crop in India, have been evolved at the Indian Agricultural Research Institute at New Delhi. Four such varieties, viz. New Pusa 718, 737, 745 and 760 are highly resistant to the brown or yellow rust and are undergoing trials in the provinces.

No wheat highly resistant to black rust has yet been evolved for profitable cultivation, although some of the Pusa varieties particularly the New Pusa 710 and 715, showed tolerance to the black rust attack when an epidemic occurred in Central India during 1946-47.

At the Simla sub-station of the Institute work is being done to evolve varieties resistant to all the three rusts. Special attention is being paid to the hill regions because it is believed that rusts die out in the plains in summer, due to intense heat, and it is in the hills that the rust survives. The first stage of this work has been successful and strains have been evolved which are very highly resistant to one of the three rusts. The work now in progress is on the more difficult problem of uniting resistance to all the three rusts in a single variety. Results obtained so far are promising. (*P.I.B.*)

PESTS AND DISEASES OF GROUNDNUT IN MADRAS PROVINCE*

THE Advisory Board of the Indian Council of Agricultural Research formulated in 1942 a plan of coordinated research for the control of pests and diseases of oilseed crops in India to be worked in conjunction with the main oilseed research schemes in force in the constituent provinces and States. Accordingly, research on pests and diseases of groundnut was allotted to Madras since a scheme of research on groundnuts was being worked in the province. The scheme was worked in Madras from 1943 to 1947 with the main object of finding out practical control measures against *surul* (*Stomoptervx nerteria*) and *tikka* leaf-spot disease (*Cercospora* sp.) of groundnut. Investigation of Red Hairy caterpillar (*Amsacta albistriga*) which is also a very serious pest was not included as adequate information for its control is available. The investigations have resulted in obtaining information of practical importance for the control of *surul* pest and *tikka* leaf-spot disease. The salient features of work are given below.

Surul (Stomoptervx nerteria)

Surul (*Stomoptervx nerteria*) is a small greenish caterpillar with dark head which mines into the leaf tissue and feeds on the green matter of the leaves ; sometimes it folds the edges of the leaf also and remains feeding inside. When thousands of these caterpillars attack the plants in a field the leaves get gradually dry, and badly infested fields present a parched or burnt up appearance. In years of low and ill-distributed rainfall this pest assumed a serious form.

Usually there are two marked broods of this pest during the growth period of the crop. As the small *surul* moths are easily attracted to light, setting up of light-traps with Dietz Junior Hurricane Lantern which are readily available in the market was tried as a means of controlling the pest. Light-traps proved effective in attracting the moths in large numbers. Population counts of insects and the yield of groundnut crop assessed at distances of 0, 25, 50, 75 and 100 yards from the light showed that the intensity of infestation increased markedly beyond 50 yards and that there was a corresponding drop in the yield of the crop beyond that distance. This indicates that the light-trap (Dietz Junior Lantern) is effective only up to a distance of 50 yards. At this rate one such light will be required to be set up for every 1·6 acres of the crop. The running cost of setting up a light-trap worked up to Rs. 3 per acre. There was an average increase of 20 per cent in yield due to the setting up of the light-trap. The value of increased produce obtained per acre was about Rs. 28 at the current market rate. Thus the use of light-trap for the control of *surul* pest appears to be profitable in years of severe infestation.

Side by side, trials were also carried out with five insecticides, namely DDT (5 per cent), 666, *Thevetia* oil emulsion, groundnut oil emulsion and crude oil emulsion for the control of the pest. Of these, DDT (5 per cent) dust proved most effective and spectacular in reducing *surul* infestation by more than 50 per cent. The next best insecticide was 666. The other insecticides did not reduce the infestation of the pest to any marked extent. The plots dusted with DDT recorded on an average 15 per cent increased yield over the control plots.

Tikka *leaf-spot*

Tikka leaf-spot disease (*Cercospora* sp.) first appears when the plants are about two months old. The lower leaves are

*From the Indian Central Oilseeds Committee

the first to be attacked. Dark spots surrounded by a bright yellow ring appear in large numbers on the undersurface of green leaves. A few such spots occur also on petioles and stem. The number of spots on a single leaf may be from one to a dozen or more and their size varies from 1/10 to 1/3 of an inch in diameter. The remaining portion of the leaf slowly loses its green colour and turns yellow. Before this yellowing is far advanced the leaf falls to the ground.

As none of the varieties in the existing collection is resistant to the attack of this disease, application of different fungicides was tried for its control. All the fungicides tried, namely Bordeaux mixture ($\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ per cent strengths), Bouisol (1 in 40 and 1 in 80 strengths), colloidal copper (1 in 40 and 1 in 80 strengths) and sulphur dust (15 lb. per acre) were observed to markedly reduce the incidence of the disease. Bordeaux mixture ($\frac{3}{4}$ per cent) however was the most effective ; it reduced the incidence of the disease by 50 per cent. The treatment with the fungicides also resulted in the stimulation of plant growth (especially in the case of copper compounds) and a corresponding increase in the yield of the crop. Plots treated with Bordeaux mixture ($\frac{1}{4}$ per cent) recorded the maximum increase in yield ; the average increase in yield obtained over a four-year period was 40 per cent.

Generally it was found that application of the fungicides at two-week intervals was definitely more efficacious than application at four-week intervals. The Spanish bunch variety which has been found to be more susceptible to the disease was seen to respond more to fungicidal treatment than the ordinary cultivated spreading variety, Mauritius. On working out the economics, the application of fungicides was found to be not profitable in the case of the spreading variety.

The results of practical importance obtained from the scheme are summarized as follows for the benefit of the cultivators :

The *surul* (*Stomopteryx nerteria*) becomes a major pest when there is drought during the period of growth of the crop. The loss in yield due to this pest is negligible when the attack occurs in the later stages of the crop. It has been conclusively proved that light-traps are very effective in attracting and trapping the moths. Lamps of Dietz Junior Hurricane type which are commonly available, are effective up to a distance of 50 yards from the light. Based on this observation one such light trap is necessary for every 1·6 acre. The use of light-trap is profitable in years of heavy infestation. Among the insecticides tried for the control of *surul*, dusting with DDT (5 per cent) was found to be the most effective. The *tikka* (*Cercospora* sp.) leaf-spot disease is easily controlled by the application of common fungicides like Bordeaux mixture, sulphur, Bouisol, colloidal copper, etc. Bordeaux mixture ($\frac{3}{4}$ per cent) however, is found to be the most effective fungicide for controlling the disease and increasing the yield of groundnuts.

You ask We answer

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in States. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

ADULTERATION OF *GHEE*

Q. Adulteration of *ghee* with *vanaspati* is a common practice these days. What steps are being taken for the easy detection of this adulteration by the consuming public ?

A. It has long been felt that in order to check adulteration, easy detection of *vanaspati* adulterated *ghee* is very necessary. Of the various methods, the colouring of *vanaspati* is being attempted for visual identification. The colour should be such as is harmless and at the same time not easily removable. Work was carried out on the colouring of *vanaspati* at the Indian Dairy Research Institute with Edicol oil orange A.S., Edicol oil yellow H.S. and Edicol oil yellow 34,257. Of these Edicol oil orange A.S. was found suitable, but had the disadvantage of being removed on boiling alone or with animal charcoal. Colouring of *vanaspati* with *Ratanjote*, however, is more successful, but there are not sufficient quantities of it available in the country.

LAND RECLAMATION

THE areas reclaimed in the different States during 1948 and 1949 with the help of tractors were 47,407 acres and 88,290 acres respectively. The information in respect of 1949 is not complete as some of the States have not yet reported.—*Food Bulletin*, February 13, 1950.

BOMBAY

I. A. SAYED

THE attention of the Department of Agriculture is focussed on the most urgent problem of the day of increasing food production to make the Province self-sufficient by the end of 1951. To accomplish this stupendous task, the Government of Bombay has put into operation a five-year plan from 1947-48 to 1951-52 for increased food production.

Several important 'grow more food' schemes have been in operation to increase food production by intensive and extensive means chief of which are: (a) supply of seeds of high yielding varieties of foodgrain crops, (b) distribution of manures such as groundnut cake, manure mixture and compost, (c) provision of irrigation facilities in dry areas where rainfall is scanty and uncertain, (d) cultivation of waste lands, and (e) reduction of acreage under non-foodgrain crops. The operation of these schemes, pushed through in practically every village of the Province, has yielded very encouraging results and during the two-year period from 1947-48 to 1948-49, 1,00,000 tons and 1,25,000 tons of additional foodgrains respectively were produced.

Pest and disease control

Largescale control measures have been undertaken against grasshoppers on *jowar* and paddy and the smut disease of *jowar*. Under the grasshopper scheme launched by the Department of Agriculture, 75,000 acres of *jowar* and 25,000 acres of paddy are being treated with Gammexane and Hexyclan during 1949. The smut disease of *jowar* can be controlled effectively by treating the seeds with sulphur powder. Sulphur powder sufficient to treat seeds required for 40 lakh acres were distributed free during the year.

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Extension of fruit cultivation

In view of increasing demand from fruit growers for reliable nursery plants of fruit trees of guaranteed quality and to ensure economic production, the Government of Bombay has sanctioned, as a part of the Post-war Reconstruction Scheme No. 15, a scheme for the establishment of fruit nurseries in different districts of the Province. The scheme was put into operation in December 1947 and so far five Central Nurseries at Puntamba (Ahmednagar district), Kosbad (Thana district), Dharwar (Dharwar district), Kumta (North Kanara district) and Ratnagiri (Ratnagiri district), and four Subsidiary Nurseries at Dhulia (West Khandesh district), Borgaon (Satara district), Arbhavi (Belgaum district) and Bagalkot (Bijapur district) have been established. The Central Nurseries at Puntamba, Kosbad, Dharwar, Kumta and Ratnagiri specialize in the production of nursery plants of Citrus varieties (chiefly *mosambi*, *santra*, grape fruit, etc.); *chiku*, *litchi* and mango; mango, guava and *kagdi* lime; mango and pineapple; and mango, pineapple and *kokam* respectively. The Subsidiary Nurseries produce nursery plants of fruit trees grown in the district.

Coconut nursery

The present production of coconut which is the principal article of food of the population inhabiting the coastal region is far below the normal requirements of the people. The substantial deficit is attributed to very

low yield resulting from planting coconut seedlings of poor quality. Trees from poor seedlings yield, on an average, 25 nuts per tree annually as against 80 to 100 nuts normally obtained from vigorously growing trees. With a view to increase production, the Indian Central Coconut Committee sponsored and partly financed a scheme for the establishment of coconut nursery at Kumta in North Kanara district for the purpose of raising and distributing, in the district, coconut seedlings of tall growing aariety and guaranteed quality at a concession rate. The scheme was put into operation in March, 1948. A target production of 10,000 seedlings is aimed at annually.

Improvement of cereals and sweet potatoes

Wheat : The resistant *durum*, variety Gaza, has been crossed with all the improved strains to obtain resistant material in *durum*.

A few derivatives from the crosses between Niphad-4 and Kenya E.14 as well as Niphad-4 and Hofod-1 have been found to be highly resistant to black stem rust both under heavy artificial infection at Mahabaleswar and under field conditions at Niphad. It is proposed to cull a couple of early selections which are better than Niphad-4 and multiply these intensively with a view to supply resistant seeds to the cultivators.

The results of experiments conducted for dry wheat at Bijapur, Niphad, Arnej and Jalgaon and for irrigated wheat at Niphad and Kopergaon show that the optimum seed rate for both dry and irrigated wheat appears to be 40 lb. per acre.

Rice : In the largescale trial conducted at the Rice Research Station, Karjat, a strain of early Kolpi No. 70 has shown superiority over early Kolamba strain No. 184 and has given 30 per cent higher yield than K-184.

Sweet potato : In largescale replicated trials conducted at the Research Station, Padegaon, over a period of three years, the two sweet potato varieties, viz. B-2 (white skin) and C.L.44 (red skin), have given 12 to 15 per cent higher yield than the local. These have been sent out for district trials and have also been multiplied at Padegaon.

ASSAM

S. R. BAROOAH

FOOD production can be increased to a great extent if cultivators use pure improved seeds. This is why the distribution of pure improved seeds to the cultivators is one of the main items of the 'grow more food' campaign. During the last few years a large amount of seeds has been distributed. But unfortunately as far as pulses, wheat, gram, etc. were concerned, the seeds were first procured from other provinces and then distributed. This resulted in delay in sowing, and because these varieties were not evolved here, they did not do very well. As for paddy some seeds were distributed from our farms attached to two experimental stations, but the amount was very small as compared to the demand. The same was the case with sugarcane, the sets being supplied from only one farm at Jorhat. The arrangement was not satisfactory and as such it was decided to start seed multiplication farms in each district to supply improved seeds to the cultivators of the respective districts.

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Seed multiplication farms

The Agricultural Department have started five seed multiplication farms only last year. All of them are in the initial stage, but even then the farms are doing very well and it is hoped to get good yield of *kharif* crops which are in the stage of harvesting. The farms are located in the different districts of the province and will cater for each district.

Horticultural development

Horticultural development has been at a very initial stage, and very little attention was given to it in the province. There are great potentialities in this direction as this is a good citrus and pineapple-growing province. In order to develop horticulture a number of district nurseries have been established. Nurseries at Wahajain, Gauhati, Nowgong, Jorhat, Dibrugarh, Tezpur, Kokrajhar and Silchar are now very active. During the preceding months more than 10,000 grafts of lime, lemon, *litchi*, guava and pears were propagated in these nurseries by vegetative means and about 5,600 grafts of the same and other varieties like Valencia, *mosambi* and Mandarim orange were issued to the growers at a moderate price. More than 50,000 suckers of pineapples and 84,000 of banana procured from selected private gardens had also been distributed during this period.

A Fruit Technological Laboratory has also been recently established at Gauhati. This has now been working with full vigour, producing many hundred bottles of fruit products. A training centre has also been opened in the Laboratory to train students in fruit technology so that they can start private enterprises.

Mechanized cultivation

A revised scheme for mechanized cultivation for the year 1949-50 has been drawn up. Under this scheme it is proposed to bring 10,000 acres of fallow and waste land into cultivation with a view to increase food production. A cultivation charge is proposed to be levied at a fixed rate per acre from the cultivators taking advantage of the scheme. The scheme is proposed to be operated in about five compact areas with about 2,000 acres of land in each.

IMPORT OF TRACTORS

TWO hundred tractors were imported during 1947-48, 156 in 1948-49, and 106 during the period 1 April, 1949 to 31 December, 1949. Of the total of 462 tractors 351 were purchased on behalf of the State Governments who had accepted full financial responsibility and the tractors, on receipt, were handed over to them. These States are : Bombay, U.P., Bihar, Sind, Punjab, N.W.F.P. (two tractors before partition), Bengal, Assam, C.P., Rampur, Mysore, Kashmir, Faridkot, Patiala. The balance of 111 tractors is in the possession of the Central Tractor Organization.

The Government have placed an order for 375 heavy tractors for land reclamation work. Ninety-one of these tractors have already been received and the balance are expected to be received by the end of September, 1950. These tractors are being imported from the U.S.A.—*Food Bulletin*, February 13, 1950.

WILL THE WORLD STARVE ?

YOU will probably have noticed that since the war a number of internationally famous experts have declared that the human race is moving into a period of acute food shortage because the increase in the world's population is not, and is not likely to be, accompanied by the necessary increase of food production. These voices do not so much cry in the wilderness, as cry about the wilderness to come. Another school of thought points out that similar gloomy prophesies have been heard before, but that the prophets have been confounded by unexpected scientific developments. This is admittedly not a subject directly related to next week's bacon ration, but its long-term importance can hardly be exaggerated. For instance, the whole question as to whether communism dominates Asia may possibly depend upon whether or not 1,000,000,000 Asiatics get more to eat than the miserable pittance on which they exist at present.

'In bringing about increased farm output', the United States Atomic Energy Commission said in its fourth semi-annual report, 'man's oldest industry—agriculture—will be assisted by his newest—atomic energy. Gains in agricultural production will result from the development of atomic energy.'

Thus far there is no evidence that the growth of plants can be increased by exposing them to atomic radiation. Atomic physics, however, is helping agriculturists to improve plants and crops by supplying to agriculture a better knowledge of plant life derived from research in dozens of United States plant and animal laboratories.

Today the 'tracer technique,' under which chemicals radio-activated in the atomic fission pile are used, is helping scientists to follow the minute chemical processes of plant life with an accuracy unattainable in pre-atomic days. The radio-activated chemicals, called radio-isotopes, are mixed to food that plants consume. They serve as a 'tag' attached to a food element for identification of that element as it passes from the soil through the roots into the plant body and the fruit. The elements so marked can be traced by radiography or radiation-sensitive instruments.

For example, zinc, copper, and manganese are important to plants even though they are available to them in amounts of less than one ounce per acre (roughly 70 grammes per hectare). Tracer study has overcome the handicap of following such minute quantities to their ultimate disposition in the plant by mixing infinitesimally small amounts of radio-activated zinc, copper and manganese to the soil, and so 'tagging' them. Because of their radio-activity, the minerals can be followed in their course through the plant. Phosphorus tagged with radio-phosphorus was found to concentrate in young maize kernels, sulphur in the seed of tomatoes.

Information of this type is helping United States agriculturalists to understand better how to use fertilizer. They are learning exactly when plants need fertilizer. They learn what fertilizer to apply. Phosphorus, for example, is used by maize, tobacco and cotton mainly in the early stages of growth. Therefore, feeding phosphorus while the plant is maturing would be wasteful. Potatoes use phosphorus throughout their growth period, but phosphorus placed very close to seed potatoes slows their growth, probably because it injures the roots. For certain other crops the manner of applying phosphorus has been found to be of primary importance. While phosphorus is the most valuable tracer chemical, some 20 other radio-isotopes are employed in agricultural research.

'Such work', says the A.E.C., 'is certain to reveal how to get more plant growth, more food and feed, from the 15,000,000 tons of fertilizer upon which the American farmer spends 500,000,000 dollars every year.'

Through the exchange of agricultural knowledge between nations, farmers throughout the world stand to benefit from such findings.

In addition to revealing the best uses of fertilizers, radio-active tracers are also being used to study the effect on plants of sulphur when it is used as an insecticide or fungicide.

A dozen other research projects aim at better understanding of how plant pests and diseases develop, how they attack plants and how they can be defeated. By tracing the action of the insect killer DDT, researchers are trying to determine how it can be applied effectively and efficiently in agriculture and animal husbandry. Diseases of poultry and livestock; the effects of soil minerals on animals; more efficient ways to produce meat, milk and eggs—all of these are being studied with radio-active isotopes in the United States.

As in human medicine, the new tools for agricultural research, the radio-isotopes, have become available in quantity through atomic fission. Radio-isotopes of scores of elements, such as carbon, phosphorus, sulphur, calcium and potassium, are being manufactured in large quantities and cheaply at the Oak Ridge, Tennessee nuclear pile. Phosphorus, most widely used, is sold for one dollar and ten cents per radiation unit (one millicurie), the A.E.C. reports. Less than 100 dollars' worth will enable one experimental station to conduct research on fertilizers for a whole season.

The results of agricultural research with radio-isotopes will come shortly. In fact, agricultural research with radio-isotopes, according to the A.E.C., has raised in one year more questions than it has answered. Because of the multitude of unknown natural processes, the A.E.C. expects that this multiplication of problems will continue for many years. Consequently, the field of research is being broadened continually by the A.E.C., the United States Department of Agriculture and agricultural schools.

With the aid of radio-isotope tracers, 18 laboratories are concentrating their studies on photosynthesis—nature's most tightly kept plant secret. Photosynthesis is the process in which, with the aid of sunlight, plants convert the chemicals of the soil and of the air into the food that makes life on earth possible. Its inner working remains largely a puzzle because of the minute quantities of soil chemicals involved. But radio-isotopes have already revealed some facts about it. In photosynthesis tests, radio-carbon has revealed to observers much of what happens to carbon in the numerous bio-chemical transformations that take place in plants before carbon appears in the sugar, the starch, the fat and other plant products men and animals eat.

Scientists working with radio-isotopes have discovered that at one step in photosynthesis a mysterious, still unidentified substance may combine with carbon with the aid of stored rather than direct sunlight. In these instances the sunlight is stored for later use by chlorophyll, the green food-manufacturing agent of plant life.

The scientists have discovered the point at which the plant divides its chemical output. From this point, one path leads to sugar, another part to starch, and another to fat. In this discovery lies the hope for controlled and greatly increased food production. If man knows exactly how plants transform the carbon dioxide of the air and other chemicals, he might learn to duplicate photosynthesis in chemical laboratories. Moreover, some scientists believe it might become possible to 'train' plants. By blocking one or the other of the three chemical production lines, plants might thus be induced to produce protein instead of sugar and fat, or fat instead of sugar and protein. In this manner, plants might be made to produce the food man wants and needs. Each kind of plant might be trained for a special purpose. Land plants and sea plants that are largely inedible might be made to yield nourishment by a process of food extraction.

Discussing the application of atomic energy to agriculture at a meeting of scientists in the State of Alabama last year, Mr. David E. Lilienthal, Chairman of the A.E.C., said:

'Much of the difference between a modern

American farm and a backward, poverty-stricken farm can be expressed in one word – knowledge. We are now in a position to unlock new knowledge about life and matter and growth and disease.... One of the most glorious promises of atomic science is that it may well help to solve one of the most vexing problems of humanity—how to keep food production in pace with the growth of the world's population.'—Reproduced from Stephen King-Hall's *National News-letter*, December 2, 1948.

THE PRESIDENT ON FOOD SELF-SUFFICIENCY

'FOOD has been a heavy item in our national expenditure and a great deal of thought and effort has been devoted to solving this problem. My Government have declared that we must make good the deficiency in food by the end of 1951. At the same time it is necessary to ensure adequate production of cotton and jute, which are essential industrial raw materials in short supply. I am glad to say that definite progress is being made in regard to food production and we are proceeding with both short-term and long-term schemes for adding to it. Food procurement is an essential part of our short-term scheme. Fortunately, the harvest generally has been good, though there has been lack of winter rainfall in certain areas and in Madras, almost complete failure. The campaign for growing more food requires the full cooperation of the people and more especially the peasantry.'—*From the address of the President to Parliament on January* 31, 1950.

COOL WATER IN HOT WEATHER AIDS DAIRY COWS

REGARDLESS of the quality of the feed or the condition of the pastures, cool water easily available in hot weather from good deep wells and flowing springs can help reduce excessive body temperature of dairy cows, which is so much responsible for a lowered consumption of feed and consequent reduced secretion and production of milk in summer, according to recent findings in studies by agricultural engineers and other scientists of the U.S. Department of Agriculture, in cooperation with investigators at the Missouri Agricultural Experiment Station.

The studies, which are a part of a continuing research programme, also showed that the greater the capacity of a good dairy cow for high, sustained milk flow, the greater the need for the body-cooling assistance from fresh water in hot weather. In these experiments, numerous scientific measurements and determinations have been made to show the close and constant relation between fresh water intake and the functional welfare of dairy cows during lactation.

They are a part of the investigations under way at the recently established 'psychroenergetic' laboratory on the University of Missouri campus, Columbia, a joint research station designed to study the relation of environment to livestock health and welfare and to provide data essential in the design of efficient and economical shelters.

High-producing cow needs more water

A high-producing cow needs extra water above that of a low producer, and above the water included in the extra milk she gives, approximately in proportion to her extra feed consumption, the investigators say in reporting their recent studies. Depriving a cow of ample water will limit feed intake and milk production. They point out that water is the solvent and carrier of nutrients to the body tissue and the wastes out of them. The blood contains over 80 per cent water and severe reduction of its water content tends to clog the circulation and interfere with normal appetite and production of milk.

In the latest report on studies of the influence of temperature on the water consumption of dairy cows, the federal and State scientists point out that a resting man in the shade at 90° F. vaporizes moisture at 15 pounds of water daily, while a 'good' dairy cow's rate is about 50 pounds daily, even though she weighs ten times as much as a man. In this connection they suggest a need for some method to entice some cows to drink cool water more frequently than they normally do, and thus help to reduce body temperatures.

As cows do not sweat, their output of urine in hot weather keeps pace with the water intake, and a cow increases her water intake not only to avoid becoming dehydrated, but also to cool her body. Cows also need large amounts of water to moisten dry feed and to churn it in the rumen. Besides this, milk itself contains 87 per cent water.

Ratio of water to milk yield

The investigators were impressed by the ratios of water to milk production and to hay consumption. The experiment showed that up to 80° F., the ratio of about four pounds of water to one pound of milk increased slowly, but beyond that temperature it increased faster, reaching at 100° F. a ratio as high as 26 to one. However, this ratio at the extreme temperature reflected a decline in milk production more than it did a rise in absolute water intake by the cows.

'It is certain that a plentiful supply of cool water in hot weather would constitute a very potent method of dissipating body heat for these slightly sweating animals,' is the conclusion. Water for the cows in the series of tests was fed to the drinking bowls by gravity from individual tanks about 10 feet above the bowl levels. The water used from the fountain only was measured. No attempt was made to regulate its temperature. (*USIS.*)

Home Gleanings

FISHERIES RESOURCES OF WEST BENGAL AND THEIR UTILIZATION*

By SUNDER LAL HORA

THE *Report on the Marketing of Fish in India* published in 1946 contains data of fish production for 1937-38. In that year, the estimated production of sea-fish in Bengal was 17·29 lakhs of maunds valued at 34·6 lakhs of rupees. The estimated surplus of freshwater fish was then 31,332 lakhs of maunds valued at 432·92 lakhs of rupees. The *Report on the Marketing of fish in the Indian Union*, now under preparation, gives the estimated production of sea-fish in Western Bengal as 5·772 lakhs of maunds valued at 85·3 lakhs of rupees. The estimated marketable surplus of freshwater fish is 11·973 lakhs of maunds valued at 335·7 lakhs of rupees. If we leave out of consideration all activities regarding grow more fish during the last decade, even then it will be found that 67·2 per cent of the sea-fish production and 62·0 per cent of the surplus freshwater fish production of Bengal have gone to the share of East Bengal. Though on the population basis (West Bengal—21,196,453 ; East Bengal—41,949,710, Census 1941), this division of fisheries seems justifiable, it must be remembered that West Bengal is the most industrialized part of the Union of India and contains within its limits the city of Calcutta, a problem by itself so far as food requirements are concerned. Moreover, people of East Bengal eat quite a lot of fresh fish at source which does not come to the market and is not recorded in the above figures.

From the figures of fish production and its value given above, the following further facts can be adduced :

1. The freshwater fisheries resources were far more valuable in Bengal, for they contributed 50·1 per cent of the total production in India. West Bengal even now leads the rest of the provinces and States in the Indian Union with 28·97 per cent of the total freshwater fish production.
2. In 1937-38, the average price of sea-fish was Rs. 2 per maund and that of freshwater fish Rs. 13·8 per maund. In 1948, they had risen to Rs. 14·7 and Rs. 28 per maund respectively.
3. The high price and production of freshwater fish indicate preference of the people for freshwater fish but, during the last decade, there has been a marked improvement in the demand for sea-fish as the ratios of sea-fish and freshwater fish prices in 1937-38 and 1948 (2 : 14·7 and 13·8 : 28) would indicate.

These important factual data must be borne in mind in considering the fisheries resources of West Bengal and their utilization. As fisheries is a natural resource, we may first briefly consider the nature of the country where the resources are located.

Physical basis of the fisheries resources of West Bengal

Bengal is a deltaic province and is, therefore, a low-lying part of India. There are, in consequence, many depressions and marshes in the lower parts and owing to fairly high rainfall they remain filled with water permanently or seasonally. In the upper parts, owing to set monsoon seasons, water is stored in ponds for domestic and agricultural purposes, so the province is dotted over with innumerable collection

* Talk given at the Discussion Meeting of the Royal Asiatic Society of Bengal on March 10, 1949.

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of impounded water of varying sizes. The rivers of Bengal carry large amount of silt and are, therefore, liable to change their courses very frequently, with the result that innumerable *bheels* are formed in the beds of dead rivers. There had been a general tendency for the rivers in Bengal to oscillate from west to east. Extensive estuaries are formed by the Ganges and the Brahmaputra, which are almost uninhabited for the greater part of the year. There are no suitable harbours on the coast of Bengal and, the silt carried down by the rivers sometimes forms bars at their mouths which render navigation hazardous even during the calm season. The bottom is muddy and soft over a greater part of the estuaries and foreshore and the continental shelf round India, particularly round the Bay of Bengal, is very narrow. The detritus carried down by the rivers fertilizes the water and the tropical temperature is conducive to fish growth.

As will be clear from the above account, the living rivers are now in East Bengal and in consequence the riverine, estuarine and foreshore fisheries are more productive in that province. In West Bengal, the salinity in the estuaries is high and most of the rivers and creeks are strongly embanked in the interest of agricultural crops. There is more emphasis on paddy cultivation than fish production in the Sundarban *abads*. The western part of West Bengal comprises dry districts, where large irrigation tanks had been constructed in the past and need for canal irrigation is being strongly felt now. The rivers are being dammed for the storage of water for multiple uses.

Resources and their utilization

We can now examine the fisheries resources of West Bengal against the background of the preferences of the people, the topography of the country and the basic peasant economy of its inhabitants. It will be admitted on all hands that an average Bengali would prefer *rohi machh* (*Labeo rohita*) to *bhekti* (*Lates calcarifer*) at any time and for this reason on ceremonial occasions *rohi* rather than *bhekti* is in great demand. The topography of the country and the present economy of its inhabitants are also more suitable for freshwater fish production and I have no doubt that, if increased fish production is measured in terms of the money spent on various schemes all over India, it will be seen that a comparatively much smaller investment in inland fisheries has yielded very encouraging results. Inland fisheries are of various kinds and each type will now be considered separately.

Pond culture

Of all the freshwater fisheries resources of West Bengal, ponds provide a wealth, which is still greatly underdeveloped, in spite of the fact that in starting the Fisheries Department in 1942, the Government of Bengal laid down pond culture as its main objective. So far as the scientific side of this development is concerned, Bengal has already been recognized as the leading exponent of this resource utilization. Unfortunately, administrative difficulties in harnessing very fully this resource have not yet been overcome. A large number of ponds are still lying in a derelict condition. Shallow ponds and *bheels*, which could be more profitably used as fisheries, are being reclaimed prematurely for agricultural purposes. Water-hyacinth is still being permitted to extend into clean fisheries.

I am given to understand that the 'Rural Pisciculture Scheme' started by me in 1944 has been considerably extended. According to this scheme, fish-seed was supplied at a subsidized rate to owners of tanks who undertook pond-culture on proper scientific basis. The operation of the Scheme also made it possible to impart necessary technical information to fish farmers, to demonstrate scientific methods of production, harvesting and utilization of fish crop, and to offer the services of a small band of technically trained pond culturists at a nominal charge to pond owners requiring services of skilled personnel.

The pond cultural practices of Bengal have succeeded in certain farms in producing 2,000 lb. of fish per annum, a food crop yield of high class protein, much greater than can be effected by agricultural practices. It is probable, however, that by following Chinese methods, which yield 4,000 to 5,000 lb. per acre per annum, further improvements could be effected. There are large areas in which the practices employed do not reach a satisfactory level and in addition

there are even large areas in which practically no use is made of the available bodies of impounded water. The fullest possible development of these resources is desirable for the long-range programme of meeting food-requirements, and steps to this end are most urgently required in the present state of West Bengal's fish supplies. Apart from its role in food production, a programme for development of pond-culture is of deep significance in relation to peasant economy, its intimate physical relation to the structure of the village, the lower level of capitalization involved and its dependence on the human element. There are three major programmes under pond culture which deserve particular attention in West Bengal and to these I shall now refer.

Paddy-**cum**-*fish culture*

I have already referred to the embanked condition of the paddy fields in the *abad* areas of the Sundarbans in the district of 24-Parganas. Simultaneously with the paddy crop, a fish crop of 100 to 300 lb. per acre is usually harvested in suitable areas, but the supply from paddy fields can be augmented several folds through proper cultural methods. In China, fish-breeding in paddy fields is used for effectively controlling the most serious insect-pest, the stem borer. The yields have thus been noticed to have increased by about 10·15 per cent. Furthermore, there are clear indications of fish-eating mosquito larvae and thereby preventing the spread of malaria. In the Dutch East Indies, fish-culture in paddy fields has been characterized 'as the highest form of pisciculture' and a higher yield of rice to the extent of 5 to 15 per cent has been reported. Small scale experiments conducted by the Directorate of Fisheries, Bengal, during 1945-46 showed an increased yield of paddy by 150 lb. per acre. The FAO Rice Conference at Baguio in March, 1948, recommended the adoption of this practice in all suitable areas. Unfortunately some critics wanted all fish of 9 in. to 12 in., removed from paddy fields, to be grown further in ponds. Those, who have some idea of the extent of the paddy fields in the Sundarban *abads*, know this is not practicable in each and every case and who among us will say that a *rohi* or a *catla* (*Catla catla*) or a *mrigal* (*Cirrhina mrigala*) a foot in length is to be despised as food? I feel convinced that this extensive resource of West Bengal is capable of great expansion for the increased production of both cereals and fish.

Bhasa-badha *or pond culture of brackish-water fishes*

Long ago Sir K. G. Gupta in his reports on the Fisheries of Bengal hinted at the boundless possibilities of increasing fish supply from the estuarine areas by 'improving and extending the system of *bheris*' which, before the Bidhyadhari river became defunct, was found so profitable in the Salt Lakes area in the neighbourhood of Calcutta. During my period of service in Bengal, a few fisheries of this type were started and some derelict ones were repaired, but the terms of the leases of land in most promising places were such that the land could only be used for paddy cultivation but not for fish culture. In spite of the best efforts of the Directorate of Fisheries, it was difficult to persuade the District Magistrates to relax the lease clauses and, in the interest of 'grow more fish' to allow the low-lying unproductive areas to be used for raising fish crops. If such administrative difficulties could be overcome, I have not the least doubt that it will be possible to bring under pisciculture vast areas adjoining rivers and creeks in the Sundarbans. There can be no better way of reclaiming low lands in these parts even for agricultural crops than through the operation of the system of *bheris* for fish culture.

Sewage irrigated fisheries

The Salt Lakes of Calcutta are no longer used as salt-water *bheris* but are now cut up into extensive freshwater fish farms. They are shallow and would normally dry up during the hot months but unfortunately the Sewage Outfall Channel of the Calcutta Corporation passes through the Salt Lakes area. The greatly diluted Calcutta sewage is taken into a number of fisheries and the results of carp production in them are very profitable. If arrangements could be made with the Corporation of Calcutta for a proper distribution of the sewage water to these fisheries, the production in this 70 square miles area will go a long way to meeting the requirements of Calcutta during March

to June when fish from other sources is normally scarce in the markets. I worked hard and planned the development of this area as a fishery but unfortunately, H. E. Mr. R. G. Casey, Governor of Bengal, who took great interest in the Scheme, left Bengal and since then little attention seems to have been paid to this most productive scheme. A public company floated for the reclamation of this area, under the combined auspices of the Government and the Corporation, will convert it into a health resort for the over-congested town and would produce large quantities of wholesome *pona* (carp) fish. The advantage of developing this area is that problems of refrigeration and transport do not arise, for with little effort fish can be sold alive in Calcutta even during the hottest months.

Before leaving the subject of pond culture, I wish to emphasize once again that the programme of pond culture in West Bengal and the proper utilization of all our resources in this line will give an immediate relief in meeting fish shortages.

Bheel *fisheries*

Closely allied to pond culture, is the utilization of *bheel* fisheries. They have been greatly neglected and overgrown with thick vegetation and now it has become difficult for individuals to reclaim them. I admit that methods of reclaiming them are not yet fully understood and, therefore, experimentation and research are called for. We have been considering development of *bheel* fisheries for at least four or five years but no beginning has so far been made. Once the Government can demonstrate a successful method of working *bheel* fisheries, I have no doubt private enterprise will not be lacking to utilize this resource for the production of fish.

Riverine fisheries

There are only a few small rivers which in their entirety belong to West Bengal. Proper conservation of fisheries of these must be planned on a scientific basis. Some of them are shortly going to have dams and weirs which will have considerable effect on their fisheries. The rivers are the main source of fish-seed supply, and if their fisheries are interfered with without making adequate provisions for the breeding of fish, besides deterioration in river fisheries, pond-cultural activities will be seriously affected.

The rivers which are common to several provinces of the Indian Union and East Bengal can only be developed on a federal or international basis. These rivers must be nationalized and suitable fishery conservation measures adopted.

Estuarine fisheries

The only estuarine areas of West Bengal are those located within the Basirhat and Namkhana Ranges of the 24-Parganas. Unfortunately, they were not of very great importance in Bengal and I did not survey them properly. For the development of these fisheries, refrigeration and quick transport are the two most essential requisites, and it is gratifying to note that the provincial budget for 1949-50 contains a provision for the supply of power craft to the existing trade for quick transport of fish. I have not seen the scheme, but presume that equal attention has been paid to the supply of ice for refrigeration purposes.

Foreshore fisheries

The chief centres of marine fisheries in West Bengal are the Moore and Fraserganj Islands near the mouth of the Hooghly in the 24-Parganas and the Contai Coast with principal fishing centres at Jalda, Samdraput, Junput and Kalagachia. I have not personally studied the fisheries of the Moore and Fraserganj Islands, but if they are comparable in any way to those of the Dubla Island at the mouth of the Passur River, then the following development measures for their fuller utilization could be suggested.

1. Arrangement for refrigeration, crushed ice in the first instance, and quick transport of quality fish for the Calcutta market.
2. Improvement in the methods of fish processing by the introduction of salt-curing, drying on raised platforms, etc.
3. Utilization of waste fish and fish-wastes in developing by-product industries on the spot.

As regards marine fisheries of the Contai Coast, I am fairly well familiar with them and would suggest the following phased programme for their development.

Phase 1: Improvement of the existing fishing methods by the supply of fishermen

consumer goods; towing out boats to the fishing grounds; use of 'Ducks' for landing catches; supply of ice in sufficient quantities; grading of fish; ensuring utilization of quality fish for table either locally, or in the Kharagpur and Calcutta markets; salt-curing of smaller fish; utilization of fish-wastes and waste fish for the manufacture of fish-meal or manure and the utilization of shark-livers for the manufacture of oil.

Phase 2: Introduction of larger power vessels as tugs and mother vessels, for taking out fishing boats beyond the limits of inshore fisheries; development of fishery cooperatives and provision of up to date marketing facilities for green and dried fish and other fishery products.

Phase 3: Employment of small power fishing vessels in conjunction with mother or factory ships, the latter for the treatment of the produce on the spot, for the safety of the fishermen and for enabling fishermen to stay away from their homes for some days.

Phase 4: Deep-sea fishing with drift and seine nets, trolling (not trawling) and long-line fishing.

I cannot say how long will each phase last, because that will largely depend on the administrative ability of the personnel and the knowledge, earnestness and industry of the technical staff employed. Of one thing I am certain in my mind that evolutionary changes, as represented in the above phased programme, will have far more chances for success in the background of the economy of the operatives and the preferences of the people than any revolutionary innovations. Short circuiting of the evolutionary programme may be possible within limits but any marked deviation may result in serious failures.

Fish supply problems

The fisheries resources of West Bengal, though perhaps inadequate for the needs of its people, are fairly varied and extensive and are capable of great expansion through well-planned economic development schemes. At the very outset, it must be borne in mind that the fish supply problems of West Bengal are two-fold, Calcutta and the neighbouring industrial areas with high purchasing power and rural Bengal with peasant economy and very low purchasing power. We shall not be serving Bengal faithfully unless we bear in mind both the problems simultaneously. I am, however, aware that the solution of the Calcutta problem may solve to some extent the problem of supply of rural Bengal as a sequence thereof.

Calcutta and the industrial centres in its neighbourhood are cosmopolitan in regard to the composition of their population, and generally speaking, their inhabitants are less conservative, more literate and hold progressive ideas. Through a well-organized marketing propaganda many innovations can be introduced in these areas. On the other hand, the rural population is very conservative, particularly in the matter of food, less literate and backward so far as modern developments are concerned. The utilization of fishery resources must be planned against this background.

Leaving alone for the time being the heavy fish imports from East Bengal and the neighbouring provinces of the Indian Union, the fish supply position of Calcutta can be improved by the utilization of the Salt Lakes fisheries, *bhasa badha* and paddy-field fisheries of the Sunderbans, development of estuarine and foreshore fisheries and the utilization of the *bheels*. Pending these local developments, which may take some time, Calcutta should import fish in ice or refrigerated holds from the West Coast by arrangements with the Governments of Travancore, Cochin and Madras. All quality fish production along the West Coast, after meeting local requirements, should be brought to Calcutta. I was greatly surprised that in the Hong Kong markets, the cheapest fish was the Canadian Herring or *hilsa*. If currency restrictions can be overcome, I would certainly like to see Calcutta markets flooded with Canadian *hilsa*. Now Calcutta and other industrial centres are feeding on the rural areas where the supply is already inadequate with the result that, in the absence of any other high quality body-building and protective food, ill health and misery are the lot of the rural population.

So far as the rural areas are concerned, the proper development of inland fisheries, particularly pond culture, holds the most brilliant prospects. Providence made Bengal a country full of tanks, ponds and *bheels* and made its people like pond-fish in preference to other varieties. It should,

therefore, be the duty of the administrators and servants of the country to fully utilize the local resources and to cater to the preferences of the people.

Bottle-neck in the utilization of resources

During my period of office in Bengal, four departments, besides the Directorate of Fisheries, were looking after the various aspects of the provincial fisheries, namely (i) Revenue Department, which provided funds for the rehabilitation of fishermen and improvement of tanks, looked after the management of *khas mahal* fisheries, and settled legal aspects of the utilization of land (paddy cultivation or fish culture), etc. ; (ii) Industries Department helped in the procurement and distribution of fishermen consumer goods; (iii) Cooperative Department worked among fishermen to organize them into effective units for production and marketing of fish and distribution of consumer goods; and (iv) Irrigation Department, that owned a large number of canal and *bheel* fisheries, looked after the sale of fisheries rights in the waterways of the province. Though for fish supplies, the Directorate of Fisheries was always held responsible for all acts of omission and commission, the position behind the scenes was lack of proper perspective and coordination between the various departments of the same Government, with the result that much energy was dissipated in commonplace bickerings and very little came out of the pooled resources of all these departments. While attending Departmental Committees and Conferences, I was always reminded of the dictum of the late Dr N. Annandale. He was of the opinion that the wisdom of a Committee is less than that of its least intelligent member. We all know by now that compromises have never paved the way to any big success but only help to postpone decisions on matters of vital importance. I do sincerely hope that, with the advent of peoples' Government, these are things of the past, though I have my apprehensions because prejudices and jealousies take a long time for their eradication. The first bottle-neck for the proper utilization of fishery resources is, therefore, lack of coordination and so long as officials do not give up 'departmental views' and learn to face the problems as a whole, much progress cannot be made.

For any development plan, there are three essential requisites, i.e. men, material and money. These essentials are arranged in order of priority. Are there suitable qualified men available in the province for taking charge of development plans ? So far as I am aware, they are very few. It is obvious, therefore, that training of personnel is priority No. 1 in our plans of fisheries development. I must make it clear here that for developing natural resources, outside experts can be of little value, and that experience of persons with knowledge of local conditions is most essential. Unless we have practical men on the scene the question of material required for our development plans does not arise, as investments made in materials in the absence of knowledgable persons to use them can be written off straightaway. The question of money, to which highest priority is paid at present, is of very minor importance. When you have practical men who know precisely what equipment is required, the results are bound to be encouraging right from the beginning and the public will then not hesitate to invest in fisheries development. Most of the major schemes would be taken up as Public Liability Concerns, partly with Government funds and partly with public funds. Taking everything into consideration, the second bottle-neck is the lack of trained and experienced personnel.

In my opinion, a lasting and nation-wide development of fisheries in West Bengal must be a slow and gradual process of the evolutionary type, in which training and experience of the personnel actually engaged in research and development will be our greatest assets. Any hurried, spectacular measures, such as trawling experiment of the 'golden crown' or training of students in American Shad Fisheries and Central European Carp-Culture Industry, are bound to fail as they had already failed not in the very distant past. Large schemes designed to bring the produce of the seas into Indian markets and to habituate the people to eat unfamiliar fishes will take years to complete. From the short term point of view, it is

necessary to carry out a large number of smaller, less ambitious, but economically sound projects which will in the aggregate increase production considerably. It is extremely unfortunate that while big schemes are being readily financed, adequate money for smaller, but highly productive schemes, is usually not forthcoming. This mental outlook with regard to the financing of schemes is the third bottle-neck to be tackled.

Conclusion

In conclusion, may I quote the concluding paragraph of Sir P. M. Kharegat's communication to the *Times of India*, Bombay, dated 14 February, 1949, on 'failure of food drive', wherein he stated :

'In short agricultural production can only be increased if a number of different measures are adopted with energy and the necessary requisites for carrying them out are made available by Government of India. There is no magic wand that can be waved for increasing output. It will not be achieved merely by talking and planning. It will entail hard and laborious work by the agriculturists and by those who have to guide them. It will require a large expenditure of money and materials. It will need a far-sighted policy by Government, giving security to the producer to ensure his wholehearted cooperation and joint working by all the departments of the Government concerned. Food production has not increased because these requisites have not been available. It is now up to Government to make them available. Will they do so ?'

The same applies *pari passu* to fisheries production in West Bengal. Our valuable resources, in spite of talking and planning for years, still wait utilization to feed the common man so as to raise his nutritional standard and to make him healthy and strong.—Reproduced from the *Science and Culture*, November, 1949.

Book Reviews

THE PUNJAB PEASANT IN PROSPERITY AND DEBT

By Sir Malcolm Darling with a foreword by Sir Edward Maclagan (Published by the Oxford University Press, fourth edition, 1947, Rs. 15.)

THIS fourth (1947) edition of this neat and thought-provoking book will be welcome to every lover of India and especially those connected with or engaged or interested in its rural and agricultural developments. It is 22 years ago that the author presented us with the first edition of this book, and in this edition 'almost no attempt has been made to revise the text in the light of the very changed circumstances of today'. The figures given in the notes have however been brought up to date and an introductory chapter has been added indicating that the book has a much wider application than the author could have guessed. 'The book was written towards the end of a long period of prosperity after the first world war. It was last revised when this prosperity had been swept away by a catastrophic fall in prices. With the World War II a second phase has come with what result cannot be gauged until condition becomes more normal and politically more settled'.

The book, though mainly based on experience gained in the Punjab, contains much that is applicable to the whole of India. In fact the Report of the Royal Commission on Agriculture in India remarked that 'the evidence we received indicates that its general conclusions apply far beyond the confines of a single province'.

For an Indian reviewer deeply conscious of the dire necessity of a reorientation of our rural life, long over-due, there is an inner urge to place before the reader many of the illuminating matters so pithily yet so impressively presented in the book. His only regret is that space will not permit it.

The main theme of the book is no doubt a critical analysis of the cause, incidence and extent of debt. This has however led to the examination of all aspects of the peasant's life. Such information is the very foundation without which no nation-building department can render real service. The book will indeed serve as a valuable guide in studies of this nature; every page bears evidence of a scientific outlook tempered with broad sympathy and vision.

Let it be said that the book is not a compilation from various sources but an outcome of meticulous study and mature experience. The author's official tenure was from 1904 to 1940; but such was and must still be his deep interest that in 1946 (i.e., six years after his retirement from service), he completed a remarkable 1,400 miles ride on horse back from Peshawar to Jubbulpur in order to acquaint himself with the effects of the second world war on Indian farmers and peasants. The reviewer's only regret is that the backward areas and provinces of India where the problems are more formidable have been less fortunate in having men of the author's type to leave a record of such an enduring value. It is earnestly hoped that this lacuna will be filled up by some of our worthy countrymen.

The indebtedness of the Punjab, or for the matter of that the whole of India, is no doubt a subject of much debate and controversy, but none can look with equanimity on the far-reaching effect of the increasing expropriation of the peasant proprietor by the money-lender. It seems unwise to allow the peasant complete freedom of alienation until he shows some understanding of the use of money; it is as a matter of fact considerably restricted in the Punjab, and Bundelkhand, but in most parts of India and Burma this is not the case. The Royal Commission on Agriculture thought it so disadvantageous that they recommended that no usufructuary mortgage should be allowed unless redemption followed automatically within 20 years. Indebtedness by itself is no doubt an evil but it is a greater evil to incur indebtedness for unproductive purpose.

The author has dealt with agricultural debt in the Punjab ; in chapters II to VII he has taken up the different tracts of the province. The subsequent chapters deal with the rise in the standard of living, agricultural progress, money-lender, money-lender's system, prosperity and debt, co-operation, and finally is given the conclusion. At the end of the book the author has given a list of 53 authors and references consulted by him. He has also given a list of vernacular words and technical terms with their meaning, and last of all a complete index.

The bulk of the cultivators in the Punjab 'are born in debt, live in debt, and die in debt'. This is equally true for the whole of India. The total agricultural debt of the Punjab in 1930 has been estimated by the author at Rs. 140 crores. It is possible that owing to the unprecedented rise in prices of agricultural produce in recent years, agricultural indebtedness has been substantially reduced. There are indications however that the benefit is probably confined to restricted areas.

Economic freedom is a condition precedent to progress. The author thinks that no progress is possible in the case of cultivators till the power of the money-lender, whether agriculturist or *bania*, is broken. His second conclusion is that the peasant proprietor cannot keep out of debt unless he is exceptionally industrious and frugal, and has a second string to the bow. His life is one of incessant toil and frequent privation. In this connection the author says that 'whereas in India rural industries are relegated to the menial castes, and market gardening is considered derogatory, and scientific stock breeding is impossible to any but a Mohammedan, the economic holding is likely to be larger than where these restraints are absent.'

The small holders are burdened with debt on one side, and with fragmented, sub-divided and holdings scattered all around on the other. The only remedy lies in cooperation and consolidation. As the author says 'important than either research or demonstration is the consolidation of holdings'. One of the most serious causes of debt is smallness of holdings. Agricultural progress is incompatible with small holdings. The author points out that French agriculture is admittedly inferior to German and one reason for this is that Germany consolidated her holdings with the help of the law, while France has left it almost entirely to individual effort.

Punjab before partition was the most prosperous province in India. Even with all the evil effect of partition both parts of divided Punjab are likely to retain much of their former position. But prosperous though Punjab has been, this prosperity is only comparative ; the rest of India is poor, only Punjab is less poor. It has yet much leeway to make up.

The supreme need is to free the masses from the disabilities of poverty and ignorance and enrich the people with the essentials of progressive life. It is necessary to awaken in us a desire to do so. This book will serve to awaken that desire. (I.C.)

FOREST PATHOLOGY

BY JOHN SHAW BOYCE (Published by McGraw-Hill Book Company Inc., New York, Second Edition, 1948, pp. x+550, $ 6.)

THE book is based on the research and information on forest and plant pathology contributed by about three hundred workers all over the world covering a period of three quarters of a century. The first edition was published in 1938 which underwent four impressions in a comparatively short period. The first book on the same subject was published in 1931 under the title "An Outline of Forest Pathology" by Dr Earnest E. Hubert. Dealing with the same subject is a third book "Pathology in Forest Practice" by Professor Dow Vawter Baxter published in 1943.

Forest pathology which principally deals with the diseases of woody plants of forests and also takes into account the decay of timber and deterioration of forest products is a daughter science of plant pathology and applied mycology. But the extension of its scope to forest products have made it more attractive and important than the nucleus from which it developed. Like every applied science the field of application

of forest pathology is ever expanding. This is shown by the growing demands of a treatise like this and the publication in the last 12 to 15 years of three well-written books and a large number of subsidiary texts on decay of timber and forest products; monographs on tree rusts and other fungi connected with tree diseases are definite proof in support.

The fact that the first edition of Professor Boyce's book underwent four impressions during the wartime is significant of its popularity and demand by the increasing number of workers in this field of more recent development. A large amount of new information accumulated during the 10 years mainly connected with the exploitation of timber resources and intensive utilization of forest products for the purposes of war, which had to be incorporated, necessitated the publication of a new edition.

The book is compiled in twenty-one chapters and two appendices (containing a description of fungicides and a list of common names of plants used with scientific equivalents) and index (Prefix x + 550 pages). The book can be broadly considered under seven main parts, namely, general mycological text, non-infectious diseases, seedling diseases, pathology and tree diseases, decay of wood and wood products, principles of disease control and appendices and index. The book is illustrated with 216 illustrations consisting of line drawings, diagrams, Tables, graphs and halftone photographs. Some of the photographs have been enlarged and reproduced better than in the previous edition. Also the size of the book has been increased from 6½ inches by 4 inches to the standard McGraw-Hill size 7 inches by 5½ inches.

Besides the above there are some general improvements on the earlier edition namely, the use of inverted comma to technicalize important mycological and pathological terms and of the names of hosts and parasites to more recent ones to make the book up to date. Information about many diseases which was vague in the previous edition has been made more definite in the present one. There are many new fungi unrecorded in the previous edition, but introduced in the present one. Portions are recast, altered, repetitions avoided, paragraphs split up and deleted and new paragraphs added for better reading. A very welcome change to one who is not an American is that citations of too many American instances have been avoided. Citations of names of many American forests in the previous edition have also been reduced. This adds to the international outlook of the present edition.

The first three chapters consist of introduction, discussion on the causation of fungus diseases and a simple taxonomic description of different groups of fungi. The chapter which interests a pathologist follows next (Chapter IV) on non-infectious diseases and pathological symptoms produced by high temperature (sun scald), low temperature (frost injury, frost ring formation, frost canker, frost scars, etc.), water deficiency (drought, heat cracks, winter drying, etc.), water excess, nutritional defects, injury due to industrial process (smoke and smelter fumes injury), salt spray, mechanical injury (fire scars, ice storms, hailstones and lightning injury, etc.) have been discussed with a complete bibliography referring to the recent works of Swingle (1944), Hepting (1945), Jackson (1945), Hansborough (1947), Hawboldt (1947) and Pamerleau (1944). The seedling diseases have also been considered into two categories, namely, non-infectious and fungus diseases. Under non-infectious diseases the above factors have been considered from the point of view of protection. Under fungus diseases damping off, root rot, snow blight, moulding, smoothering, spots, etc. due to the attack of fungi of lower orders (Phycomycetes and Fungi Imperfecti) and Ascomycetes and a few Basidiomycetes have been discussed. For controls of seedling and nursery diseases selection of disease-free seeds, proper planning of nursery and selection of nursery sites have been given the utmost importance. Although the list of causal agencies is not complete and reference has been made to pathogenes known in the U.S.A., the items of control practically cover the whole range of such diseases. The root diseases due to shoe-string fungus (*Armillaria mellea* (Vahl.) Quel.) has received adequate recognition (Chapter VI). Contributions on the pathology of root and buttrot fungus (*Fomes annosus* (Fr.) Cke.) from the U.S.A. and

Europe are mostly of recent years (1930 to 1946); the readily accepted theory of root wounds and frost injury in the butt region have been discussed with a few remarks on control methods. A short description of root-diseases due to other organisms of the family Basidiomycetes, Ascomycetes, Phycomyceres, Fungi Imperfecti and virus (Phloem Necrosis of American elms—Swingle 1942, Tucker 1945) have been given. A short account of mycorrhiza has also been included.

The foliage diseases have been described in two parts of hardwoods (Chapter VII) and of conifers (Chapter VIII). The former include leaf spots, tar spots, twig blights, powdery mildews, sooty moulds, rusts, blisters, flower and fruit rots deformations, scab, and canker of tender shoots caused by various pathogenic fungi including rusts, Ascomycetes, Fungi Imperfecti, etc., a short but comprehensive account being given.

Under the latter, are included distribution, pathology and biology of leaf blights and needle casts due to various ascomycetous fungi such as cedar leaf blight due to *Keithia thujina* Durand, needle cast of Douglas fir due to *Rhabdocline pseudotsuga* Syd., needle cast of balsam fir due to *Hypodermella nervata* Darkar, needle cast of pines due to *Lophodermium piniastri* (Schrad) Chev. *L. juniperinum* (Fr.) de Not., *Hypodermella concolor* (Dearn.)Darkar of jack and lodgepole pines have been given, besides several others under the miscellaneous foliage diseases. Under needle rusts distribution, life-cycle, pathogenecity of cedar and juniper needle rust (15 species of *Gymnosporangium*) have been considered in detail because damage to the pomaceous hosts is often serious in the West Coast, North Central and Lake Region States of the U.S.A., and in the provinces in the North Central and Western Canada this disease has become of economic consequence as valuable orchard trees are attacked by 'cedar apple' rusts. Control measures include spraying the orchards and isolation of the alternate host. Besides *Gymnosporangium*, about 70 species of needle rusts, most of them being hetroecious, have been described hostwise such as Pine Needle Rusts (*Melampeoraw*, *Melampsorrella*, *Uredinopsis* and *Milesia*), Hemlock Needle Rust (*Pucciniastrum*) and Larch Needle Rusts (*Melampsora*). The distribution, and biology have been given, keys to the well-known American species also being included. Also included in the list are unrelated species referred to by *form genera Peridermium*. In the description the classical works of various well-known uredinologists both American and European (Tubeuf, Klebahn, Arthur, Farlow, Jackson, Faull and his collaborators) have been referred to and cone rusts (*Cronartium*) described.

The stem rusts of conifers which cause 'witches' brooms', swellings, blisters and galls of stem and cause dieback or kill young trees outright are of greater economic importance and have received detailed treatment in two sections. Distribution, biology and pathology of ten hetroecious stem rusts, except in case of Woodgate Gall Rust the identity of which is not known and of Western Gall Rust (*Cronartium harkensii* (Moore) Meinecke) which is suspected to be identical with Eastern Gall Rust (*Cronartium cerebrum* Hedge and Long= *Cronartium quercuum*), have been described in details. We owe our knowledge of the rusts which perenneate in the stems of conifers to the American workers and much of the work has been done in the Experimental Station laboratory distributed in various states of the U.S.A. and provinces of Canada by pathologists and foresters who cooperated to tackle the problem from every angle. Nothing could be more welcome to the students of forest pathology than the complete and up to date supplementary information at the end of each chapter. One chapter has been allotted to the White Pine Blister Rust in the U.S.A. which is introduced from Europe. The amount of damage it caused to the pines, endemic as well as introduced, was a problem of paramount importance to the States for a quarter of a century. This rust deserves a special and prominent reference. References have been made to the work of about one hundred workers in the States and Canada; and a direct method of control has been successfully worked out. The White Pine Blister Rust, the Chestnut Blight Disease and Dutch Elm Disease have strengthened the hands of American phytopathologists in enforcing quarantine laws.

This is followed by two chapters on the stem diseases of conifers and hardwoods. In the former canker due to Ascomycetes such as canker of pines due to *Tympnis* sp., canker of larch due to *Dasycypha Willkommii* (Hart.) Rehm and other species of *Dasycypha*, and due to Fungi Imperfecti such as *Macrophoma* sp., *Phomopsis lokoya* Hahn have been described and symptoms and etiology detailed. These diseases attack trees growing under unfavourable conditions in the virgin forests of the United States, the descriptions of these parasites therefore have been given from the point of view of the American worker. None of these diseases, however, has been recorded in India.

In dealing with the stem diseases and cankers of hardwoods which are of more serious consequence than those of conifers the author has added many new diseases. These diseases are difficult to diagnose and still more to control unless etiology is known. Protective measures which were merely suggestions have now become definite with the increasing knowledge of the etiology and biology of the organisms. This chapter has considerable additional information as compared to that of the previous edition.

Amongst the Fungi Imperfecti, Dothichiza and Septoria Cankers of oak and chestnut, Sphaeropsis Cankers of oak ; and amongst the Ascomycetes, Black Knot of cherry (*Dibotryon morbosum* (Schw.) T. & S.), Didymosphaeria Canker of alder, Cytospora Canker of willow, Neofabraea Canker and Hypoxylon Canker of poplar and Eutypella Canker of maple have been described. Nectria Canker (*Nectria galligena* Bres.) of yellow poplar and magnolias and Beech Bark Disease (*Cryptococcus fagi* Baer. followed by *Nectria cocina* var. *faginata*) with symptoms and etiology have been described in detail. Lastly, the Chestnut Blight or Endothia Canker of chestnut has been described under various sections, such as history, distribution, hosts, damage, epidemiology, symptoms, causal agency and control. This section has been presented in a somewhat condensed and altered form as compared to that in the previous edition. This fungus was formerly considered as a dangerous parasite of forest-*cum*-horticultural plants of American importance. The chestnuts including several species and varieties and their hybrids are now recognized to be important endemic timber trees of many of the warm temperate regions. Besides China and Japan of Far Eastern Asia they are important timber trees of various warm countries of Europe like Portugal, Spain, Italy, Czechoslovakia and the Balkan Provinces, and the chestnut disease survey points out that Endothia Blight is gradually spreading in all these countries. Horticultural, genetical and pathological experiments are now carried out in almost every country where chestnuts are regarded as important timber trees to fight out this pest. The Chestnut Blight Disease of America is now a wider problem for the geneticist and tree pathologists as it affects vaster regions of Europe and Asia and the information regarding all aspects of the problem will be useful for the workers concerned in this field.

Also from the point of view of practical plant pathology and its application to forest protection the subjects that can be profitably investigated and have appeal to a practical tree doctor are included in the study of stem diseases and decay due to parasites and their prevention. Likewise the study of the causal organisms producing rot in timber would appeal to a timber doctor with the object of formulating the methods of prevention. Consequently in recent years more attention has been paid to this side of forest pathology, i.e. the etiology than to work out the methods of prevention which have been left to a specialized or selected group of workers. This is reflected by a large number of publications investigating the modes of infection, epidemiology, etiology, causal organisms, etc. listed at the end of the chapters.

Under Stem Diseases non-infectious and infectious galls have been discussed in two chapters. Short accounts of dieback of hardwoods due to *Nectria cinnabarina* (Tode) Fr., of pines caused by *Cenangium abietis* (Pers.) Rehm., of butternut by *Melanconis jugulandis* (E. & E.) Graves and of other miscellaneous hardwoods due to various species of Fungi Imperfecti have been given. A complete description of Dutch Elm Disease has been given under several sections, namely, history and distribution, hosts, damage, symptoms and the causal agency

from the point of view of American workers. For protection of elms, sanitation against the bark beetles that spread the fungus, spray of technical DDT dissolved in fuel oil or xylene with emulsifying agents in case of living trees have been recommended, strengths of various components for the preparation of the spray fluid having been given.

A concise description of American mistletoes with a key to the American species of *Arceuthobium* together with the host list have been given in Chapter XV. Protection methods have been discussed in detail from the pathological and sylvicultural point of view for all types of forests including nursery stocks and virgin stands. At the end of the chapter some aspects of biological control have been discussed and a few enemies of mistletoes have also been referred to.

Further elaboration of Stem Diseases due to various hymenomycetous fungi which are regarded as facultative parasites and for brevity termed 'decay' opens Chapter XVI which introduces timber pathology. The descriptions are concise but a full treatment has been given under each section which follows in succession such as Types of Decay, Gross Characters of Decay, Chemistry of Decay, Microscopic Characters of Decay, Resistance of Fungi Causing Decay and Control of Decay.

Under section on microscopic characters of decay, the penetration of hyphae through the cell-wall has been attributed to chemical action, the cell-wall being locally dissolved by enzymes, in advance of the actual passage of the hyphae (Proctor 1941), and the enzymes being secreted solely by the tip of the hyphae ; but when the bore hole is enlarged, enzyme secretion is not confined to the hyphal tip. The mechanical theory having no support has been abondoned. Further evidence supporting the chemical theory more strongly are the elongated bore holes orientating parallel to the long axis of the secondary walls of the fibres (Bailey and Vestal 1937 ; Tamblyn 1937). This phenomenon cannot be explained by mechanical theory.

The importance of isolation of decay and the examination of cultural characters which have been recently followed in the diagnosis of decay (Campbell 1938 ; Davidson, Campbell and Vaughan 1942 ; Robak 1942) have been emphasized. Special media which accelerate the formation of sporophores (Badcock 1943), oxidase tests with gallic and tannic acid in malt agar media and the guacum tests are useful recent additions.

Under the section 'Control of Decay' methods of scaling and estimating decay in trees and logs have been discussed and the methods to calculate the volume of rot and sound timber in stands and timber have been given. This is a very important pre-requisite for practical training of staff employed in the timber trade. The author has considered decay in various American softwoods such as Western Conifers which include Douglas fir due to (a) *Fomes pini*, (b) *Fomes laricis*, (c) *Polyporus schweinitzii* and (d) *Fomes roseus* ; sitka spruce due to *Fomes pini* ; western hemlock due to *Echinodontium tinctorum*, *Fomes emosus*, *F. applanatum* and *F. pini* ; white pine and lowland white fir due to *E. tinctorum* ; red fir also due to *E. tinctorum* ; western white pine due to *F. pini* ; ponderosa pine due to *Polyporus anceps* and incense cedar due to *Polyporus amarus*. Data from various Canadian and American laboratories and references to well-known workers such as Bier, Foster, Salisbury, Weir, Lewis, Hubert, Englarth and author himself have been included. Importance of such timber like sitka spruce which was used for aircraft during the second world war, red fir, ponderosa pine, etc., not mentioned in the earlier edition, has been stressed and decay tests included. Formation of the top rot of hardwoods and its relation to the incidence of wounds and rotten branches and the data from the works of Davidson and Campbell (1943) on Black Cherry Rot on the estimation of cull defects are recent additions.

The largest number of contribution on stem and timber decay in recent years are mainly from the forest products laboratories of Germany, Sweden, England, Canada and the U.S.A. and also from the laboratories under many industrial concerns processing timber and wood products and are referred to in Chapter XVII. The author has given a complete but concise description of some of the important American timber destroying fungi, namely, Red Ring Rot

(*Fomes pini* (Thore.) Lloyd), Red Ray Rot (*Polyporus anceps* Pk.), White Trunk Rot (*Fomes igniaris* (L.) Gill), Brown Stringy Rot (*Echiniodontium tinctorum* E. & E.), Red Brown Rot (*Polyporus schweinitzii* Fr.), Balsam Butt Rot (*P. balsamsus* Pk.), Brown Trunk Rot (*Fomes laricis* (Jacq.) Murr.). Besides short descriptions of about 80 species of hardwood and softwood decay have been given as against 62 species in the previous edition and estimates of losses due to decay both in use and storage with data where available have been included. The section on dry rot has however been disposed of with short remarks on *Poria incrassata* (B. & C.) Curt. with a mention of *Merulius lacrymans* (Wulf.) Fr. The bibliography on the rots is complete and from all parts of the world.

The last three chapters are important from the point of view of timber industries, lumbering, utilization of forest products, etc. and subjects dealt with in section under different categories are the Deterioration of Dead Timber (Chapter XVIII), the Deterioration of Forest Products Decay (Chapter XIX) and Deterioration of Forest Products : Sap stains (Chapter XX). The author discusses the methods of salvage of killed trees, decayed and stained wood and wood products, which should be the main objective of every lumbering operation to save losses by salvaging material before any further deterioration sets in. The sound principles of lumber industry are based on secondary operations and salvage of the so-called waste material. Insect-killed, fire killed wind-thrown timber and slash, etc. add to the losses in these days when the rates of handling timber, labour and transports are climbing up sky-high.

Biotic factors are responsible for tremendous losses of timber resources in our tropical forests, the information given in these three chapters should prove very useful guide to our foresters, lumbermen and industrialists if the basic principle involved is properly understood. Fire, insect and wood-rotting organisms are considered as natural enemies of the tropical forests. We have no adequate means to stop them, but proper logging of insect-killed and fungus-decayed material would certainly save a fortune provided we are able to work up the proper schedule of deterioration set up at different stages so as to ascertain how long such timber could be left in the coupe at the time of the year when transport to the mills is not practicable. Fire is the greatest curse of our tropical and subtropical forests. We have no means to calculate the actual amount of loss to the forests caused by these agencies but the estimated loss is tremendous, running to many crores of rupees. The foresters, scientists and industrialists must combine to make the best of a bad job by salvaging the waste, and the science of forest utilization must prove its worth by finding out how the waste products should be put to the best use.

From the utilization point of view the natural resistance to decay due to the by-products of plant metabolism such as tannin, volatile chemicals, colouring matters, toxic oils, resinous exudations (non-toxic but preventing penetration of wood destroying fungi), etc. have been considered. Under the section of decay of pulp wood and pulp, methods of hygienic storage, proper piling and chemical treatment to protect material for pulp have been briefly discussed. The loss to our pulp material (bamboo, in particular) is very high, due to the fact that sap stain is active in the monsoon season for four to six months, and in some parts of the country at the time the material reaches the crushing mills it appears carbonaceous. Storage is a difficult problem for the paper industries. To save this tremendous waste we should have more chemical protection of pulp material prior to monsoon when dry storage is almost impracticable.

Much work has been done by American workers, by Findlay (1939), Schaffer (1940, 1941), Lindgreen (1940), Champman (1940), Verrall (1939, 1941, 1945) and others in recent years on sap stain since the publication of Professor Boyce's book on Forest Pathology in 1938. Stains on wood products, which were regarded as minor defects in timber, especially the blue stains of softwoods, are now considered as one of the major handicaps of the marketing of finished wood products. The loss on this account is estimated at over 10 million dollars in the United States alone. The chapter includes much information available on the

control of sap stain (Schaffer and Lindgreen 1940) and chemical protection in dipping solutions (Hartley 1945, Schaffer 1946) both as a laboratory test and in the lumber mills with pre- and post-seasoning processes.

Under the section 'Decay of Structures', fungi causing decay of building and other permanent structures and methods to prevent such decay have been summarized. The section on wood preservation has been unusually abridged but a complete reference to the subject has been annexed.

The author discusses the fundamentals of forest disease control in Chapter XXI under two categories namely, the control of native diseases and the control of introduced ones. The basic principle involved being different in two cases, the methods evolved have been justified by sound arguments and exposed in lucid language. With the native diseases sound silviculture, selection of sites, adjustment and judicial composition of the crop at the time of restocking, preference to mixed in place of pure stands in the second rotation or second cut stands; selection of seed, acclimatization of the species when introduced from one region to another, and lastly, the breeding of forest trees to improve resistance have been considered and merits and demerits discussed while trials of exotics in place of susceptible native species have been equivocally discouraged. Introduced diseases are infinitely more destructive and require more expensive direct measures. The author has quoted glaring instances of half a dozen of pests introduced to the United States during the last 50 years, such as the Chestnut Blight Disease, White Pine Blister Rust, the Dutch Elm Disease, Willow Blight, Larch Canker, Beach Bark Blight, etc. The lack of judgment in the initial stage to estimate the harming capacity of potential parasites and finally delay in taking quick action against them have given them enough time to establish themselves on the native American hosts. Also the unsatisfactory quarantine laws and their failure to exclude disease-propagating stocks and forest products, through which the diseases were introduced in the United States in the earlier parts of the century, have been deplored. The slow method of investigating and cruising (estimating) the diseases at the time when they are first noticed has also been criticized. Finally the principles governing control of introduced parasites have been summarized and the views of Ditwiller (1929) and Fracker (1937) have been put forward. Public opinion has to be roused for sanitation; destruction of the diseased stock eradication in an extensive control programme, and lastly, passing of legal enactments, when persuasive methods fail, have been emphasized.

Although the control details aim at checking pests endemic and introduced of native American trees, the basic principles are applicable to any country faced with such situations. We have fortunately no record of introduced tree disease that has developed in a dangerous stage. The disease of our evergreen and deciduous hardwoods and of the conifers in the Himalayas so far recorded are endemic and endemic diseases never develop to such dangerous proportions. Furthermore, against native parasites direct control is rarely necessary or justifiable. We have a large number of resistant hardwood species and as regards conifers, the Himalayan species though few, are sufficient for our home requirements, and except as a trial on an experimental basis, there is little need to introduce exotics in India.

During the last world war it was a difficult proposition to safeguard the introduction of new diseases in any country involved in the struggle. We have records of *Trametes serials* and *Poria monticola* reaching our shores in a consignment of sitka spruce and Douglas fir timber. There is every likelihood of other parasites invading our country through agricultural and forest products at this stage, when we are in a state of reorganization, Professor Boyce's remarks on the quarantine regulations should be more fully realized.

This book which is the only one of its kind will be invaluable for students and teachers of forestry, the forester, the silviculturist and private owners of small forest lands. This book will be equally handy to lumbermen and to those who invest in timber trade will find useful information on how to cruise sound and diseased stock and how to salvage left-over material and save diseased trees and defective forest products from further deterioration. The complete bibliography is time saving to the students, as no other complete and up to date reference is available in this country. (K.B.)

News and Views

INCREASED FOOD PRODUCTION OF ONE MILLION TONS

DETAILS are available of the Government of India's plan of stepping up food production in the country, as a result of the 10-million dollar loan recently sanctioned by the International Bank.

It has been planned to increase production in the country by one million tons annually by reclamation, during the next seven years, of a total of three million acres of weed-infested land, which had been out of cultivation for a number of years. An additional 120,000 acres of new land would also come under cultivation after reclamation. For this type of work it was essential to use heavy crawler tractors, which plough to a depth of 12 to 14 inches.

The loan from the International Bank would enable India to get the necessary dollars for the tractors and some of the equipment in the United States. Heavy ploughs, workshop machinery, etc. would be purchased from non-dollar areas. There would also be expenditure in the maintenance and operation of the tractors. The total cost would amount to Rs. 15 crores spread over a period of seven years.

The reclamation of *kans*-infested land would be confined to the Bundelkhand Division of the United Provinces; parts of Madhya Bharat, particularly Gwalior, Jubbulpore Division of the Central Province and Berar and Bhopal. Of the 180 tractors which are expected to go into operation during the ensuing season from January-May 1950, the largest number of 150 will be in the Central Province and Berar, followed by 105 in Madhya Bharat, 60 in Bhopal and the rest in Bundelkhand in the United Provinces. Thirty tractors will also be employed for jungle clearing work in the Tarai region of the United Provinces.

It is expected that by the season January to May 1951, all the 375 tractors purchased through the International Bank loan will be working, bringing for the next five years, 480,000 acres of land under cultivation every year. This would result in an annual increased production of 160,000 tons of *rabi* grains on a progressively increasing basis, and ultimately in one million tons per annum when the whole scheme is completed. (*P.I.B.*)

CORRIGENDUM

The author's name of the article entitled, "Treat your cereal seeds and control many serious diseases," appearing in the November, 1949 issue of *Indian Farming*, has been wrongly printed as Dr H. S Pruthi. The author of the article is T. B. Lal, B.Sc. (Agri.) Assoc. Indian Agricultural Research Institute, Plant Pathologist, Directorate of Plant Protection, Quarantine and Storage, Ministry of Agriculture, Government of India.—*Editor*.

COOPERATIVE FARMING TO INCREASE PRODUCTION

COOPERATIVE farming which can prevent the loss of production arising out of extreme fragmentation of land that is prevalent in India is discussed in a brochure published by the Economic and Statistical Adviser to the Ministry of Agriculture.

The average size of an agricultural holding in India has been estimated at between three and five acres as against 145 acres in the U.S.A., 40 in Denmark, 25 in Sweden, 21·5 in Germany and 20 in England. Even this small average is further falling. Besides, each individual holding is not merely small but often is scattered over a wide area in tiny bits, which stand in the way of their economic cultivation. Increased agricultural production, which is necessary for a country at any time, is of vital importance to India at the present moment as land constitutes the fundamental factor for solution of a number of pressing problems with which the new government has been faced. Resettlement of the ex-servicemen, rehabilitation of displaced persons, abolition of zamindari and finally, the 'grow more food' campaign, all depend on how the available land is put to the maximum economic use.

The problem is a stupendous one as agriculture representing the largest field of human endeavour embraces millions of people with inherent rights in the soil, accrued for generations. In India, the basic structure of agricultural economy has been private proprietorship handed down from the father to the son. The individualistic bias of the cultivator and the natural tendency to resist anything which even indirectly interferes with his proprietary right are factors which have to be faced in any scheme of reforms.

The brochure, therefore, advises cautious, gentle approach with formation of multi-purpose societies at the outset, followed by intense cooperative education which would put before the farmer the benefits of cooperation in a concrete way. It points out that the idea of cooperation though not widely prevalent is not unknown in India. During sowing and harvesting seasons mutual aid and neighbourly collaboration between farmers are noticeable. Sometimes for growing an expensive crop like sugarcane, a closer degree of joint effort is required and the farmers agree to pool their resources of land, labour and equipment for limited periods for the purpose.

Again, during the war when the normal channels of production and trade broke down to some extent, cooperation received a fillip as the daily economic problems of the people compelled them to form cooperative societies for meeting their current needs. These cooperative societies shouldered, in many places, the responsibility for distributing foodgrains and other essential goods to the population. Recent figures have shown that there has been a very large increase in the number of cooperative societies in the provinces and the share capital has also considerably increased.

This spirit of cooperation which already exists in a smaller degree needs to be developed. As an immediate measure, cooperation aims at increasing the production for making the country self-sufficient in food and industrial raw material; as a permanent measure of improvement, it affords the best means of rationalizing agriculture and attaining a higher order of social and economic life in keeping with the principles of democracy and self-government. To the State it provides a handy and useful agency for enforcing its production programme.

To begin with, multi-purpose societies aimed at not only increasing the production of the land but also to provide marketing and credit facilities, seeds, manures and other services and for development of cottage industries, should be formed. The next step should be some measure of consolidation of holdings so that compact areas

could be available for cultivation. Such multi-purpose societies should be co-terminus with the village, as far as possible, and Government assistance should be given to encourage their formation in every possible way. In addition to providing the necessary guidance and technical assistance, encouragement in the form of a subsidy towards meeting the cost of management for a few years at the beginning and reduction in assessment for the first few years are recommended. Fertilizers and manures, improved seeds, implements and other capital equipment should also be made available to the society on cheap terms.

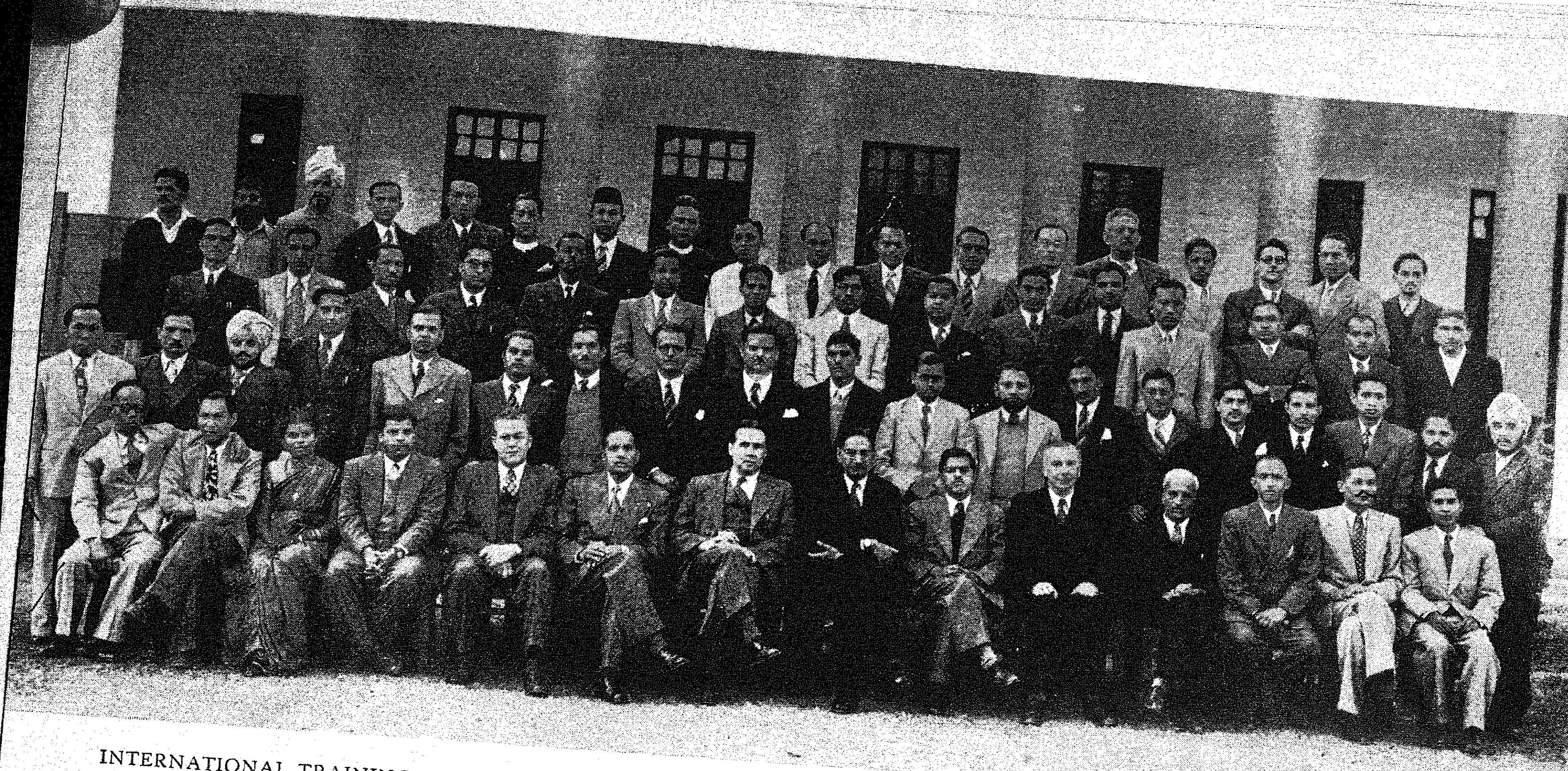
Provincial Governments should give top priority to such schemes and suitable organizations should be set up consisting of representatives of cooperatives, of the provincial Agriculture Departments, *Panchayat* Officers and prominent agriculturists.

Newly reclaimed lands, the brochure suggests, should be allotted only on the understanding that cooperative farming will be introduced by the allottees. It points out some of the recent experiments on this line that have been undertaken, e.g. in the Ganga Khadar and Tarai areas of the United Provinces and suggests that steps should be taken to ensure that they do not revert back to the individual cultivation system. Insistence on ownership rights, individual cultivation and dependence on hired labour leading to the emergence of a non-cultivating class are the three major factors which retard cooperative development and the brochure warns that these forces should be resisted.

The main problem is the introduction of cooperative farming on old lands and in this field a number of Provincial Governments have already started schemes which are analyzed in detail in the brochure. The brochure also mentions the various forms of joint farming that are prevalent in different countries of the world and to what extent they are applicable to India. (*P.I.B.*)

COVER ILLUSTRATION

Cruising at night.



INTERNATIONAL TRAINING CENTRE ON CENSUSES AND STATISTICS FOR SOUTH-EAST ASIA AND OCEANIA, NEW DELHI
(November 1949—February 1950)

Sitting (Left to Right) :—Mr. C. Sanit (*Thailand*), Mr. K. Amporan (*Thailand*), Miss K. Breckenridge (*Ceylon*), Mr. G. R. Seth (*India*), Mr. Morris H. Hansen (*U. N.*), Mr. C. K. Dilwali (*U.N.*), Mr. Forrest E. Linder (*U.N.*), Mr. P. C. Mahalanobis (*India*), Mr. P. V. Sukhatme (*India*), Mr. C. P. G. J. Smit (*F.A.O.*), Mr. T. S. Krishnamurti (*India*), Mr. H. C. Thapar (*India*), Mr. Jin Jaiprabha (*Thailand*), Mr. L. Nit (*Thailand*).

Standing, 1st Row :—Mr. K. Udom (*Thailand*), Mr. N. K. Adhikary (*Nepal*), Mr. Swaranjit Singh (*India*), Mr. R. N. Kalsi (*India*), Mr. G. C. Mallik (*India*), Mr. H. N. Banerjee (*India*), Mr. M. Patnaik (*India*), Mr. G. G. Laulkar (*India*), Mr. C. A. Majid (*Pakistan*), Mr. Kr. B. Singh (*India*), Mr. C. M. Revanna (*India*), Mr S. A. Hameed (*Pakistan*), Mr. D. Ranga Ramanujam (*India*), Mr. V. N. Poornapregna (*India*), Mr. D. R. Kohli (*India*), Mr. N. Shamsi (*Pakistan*), Mr. S. Hadisapoetro (*Indonesia*), Mr. A. Hanif (*Pakistan*), Mr. Kuldip Singh (*India*).

Standing 2nd Row :—Mr. H. N. Sharma (*Nepal*), Mr. N. B. Basnyat (*Nepal*), Mr. T. B. R. Majhi (*Nepal*), Mr. Prem Nath (*India*), Mr. R. S. Asthana (*India*), Mr. J. N. Sarma (*India*), Mr. D. V. Rangnekar (*India*), Mr. H. G. Punja (*India*), Mr. P. Misra (*India*), Mr. M. M. Babbar (*India*), Mr. M. A. S. Rajan (*India*), Mr. S. M. Joshi (*Nepal*), Mr. K. B. Varma (*India*), Mr. D. R. Gupta (*India*), Mr. R. C. Arora (*India*).

Standing 3rd Row :—Bir Singh, Santaram, Chander Singh, Mr. F. C. V. Wickramaratne (*Ceylon*), Mr. B. Malayu (*Indonesia*), U. Soe Hlaing (*Burma*), Mr. Sujitno (*Indonesia*), Mr. U. Aung Tint (*Burma*), U. Thein Han (*Burma*), Mr. Roeslan Babee (*Indonesia*), Mr. S. P. Kartosoedirdjo (*Indonesia*), Mr. Seegeng Amat (*Indonesia*), Mr. Chung Hong-Sup (*Korea*), Mr. B. S. Sawhney (*India*), Mr. V. N. Panditrao (*India*), Mr. J. Royer (*Indo-China*), Mr. D. Pokpan (*Thailand*), Mr. B. M. L. Sharma (*India*).

PLATE 2?

INDIAN FARMING

MARCH, 1950

Vol. XI

No. 3

AGRICULTURAL RESEARCH IN INDIA*

IT gives me very great pleasure to speak to you today about the Indian Council of Agricultural Research and what it has been doing. Doubtless, as officers who are going to hold high and responsible positions in the various provinces of India, you will be very much interested to know something about the work of the Council in relation to the well-being of the people of India.

Agriculture is unquestionably the most ancient industry known to mankind because it is the means by which all living beings on the earth have survived and spread themselves throughout the globe. It has developed by a gradual process of improvement with increased population and better education culminating in what we have today.

The improvement of Indian agriculture has been attempted by many governments over a long period of years and by a variety of methods. In the first instance, western methods were introduced on the assumption that as they had succeeded in the countries of their origin, they would succeed also in India, but this was found to be a failure. Then followed a period of search for some general policy or system of organization. Little was, however, accomplished in this direction. Finally, it was recognized that Indian agriculture constituted a problem of its own and that it had to be developed to accord with the natural conditions of the country and the requirements of its people. This conclusion was reached mainly as a result of pressure of events rather than of deliberate planning. India has been subjected to famines from time to time and the origin of concerted measures for improvement of agricultural methods naturally resulted from efforts to ward off these periodical calamities.

The first body to seriously study possible methods of improvements was the Famine Commission of 1880. Definite action began a few years later when in succession certain experts were invited to organize agricultural research and improvement. In 1901 another Famine Commission was set up and this body laid great emphasis on the necessity for the establishment of properly organized agricultural departments in the provinces capable of applying scientific methods to the improvement of agriculture. Lord Curzon's Government took prompt action on these recommendations and the result was that re-organization of the Agricultural Departments in India was taken in hand. The existing departments were strengthened on the experimental and scientific sides, agricultural colleges were established including the Central Research Station at Pusa and other organizations for the purpose of providing sound information about Indian soils, crops and animals. This position was made more definite by the Government of India Act of 1919 which placed the main responsibility for agricultural development upon the Provincial Governments, but reserved to the Central Government the right to promote research by means of Central Institutes and other agencies.

Then came the Royal Commission on Agriculture in India which can really be said to have inaugurated a new era in the history of agricultural research and development in India. This Commission brought

*Address by Sardar Datar Singh, Vice-Chairman, Indian Council of Agricultural Research, to the I.A.S. probationers at the Indian Administrative Service Training School, Metcalfe House Hutments, Delhi, on 3 December, 1949.

out prominently the fact that the problem of improving Indian agriculture was really the problem of improving Indian village life and its far-reaching conclusions set out in its report in 1928—the most comprehensive account of Indian agriculture yet published—were speedily examined by the government and given effect to, to the maximum extent possible. The creation of the Indian Council of Agricultural Research was in pursuance of one of the recommendations of this Commission.

Before I refer in detail to the organization and functions of the Council and what it has achieved so far and how it has to be developed in future, it is necessary to refer briefly to three of the most important institutions in the country in which modern organized research was first initiated. The first one is the Indian Veterinary Research Institute, which was set up in 1890 in Izatnagar, to investigate the diseases of animals. One of the earliest activities of this Institute was the preparation of an improved serum for the elimination of rinderpest of cattle. From 1920 this Institute began to direct its attention to research to promote the development and maintenance of healthy animals by the study of nutrition. On the agricultural side, the establishment of the Imperial Institute of Agricultural Research in Pusa marked the beginning of organized research in India. This Institute provided fully equipped laboratories for scientific research, an experimental farm, an agricultural college for the training of students and a cattle farm for the improvement of local breeds of cattle. I should acknowledge in this connection the assistance received in the setting up of this Institution from an American gentleman, Mr. Henry Phipps of Chicago, who made a handsome donation of £30,000 for the development of scientific research in India. From the time of its inception, this Institute has grown from strength to strength with the help of its very able scientific workers and you may remember that it was shifted to New Delhi in 1936 after the earthquake.

Unlike agriculture and veterinary science which received early attention, the improvement of dairy science was attempted in an organized manner only from 1920 when the Imperial Dairy Expert was appointed. At the earlier stages, the work of this expert lay along the lines of breeding and cattle improvement and it was not until the Indian Council of Agricultural Research came into being and the Indian Dairy Research Institute was established in Bangalore that organized research strictly pertaining to dairy science was commenced.

The early attempts made in India for the improvement of agriculture and animal husbandry, however, could touch only a fringe of the vast problems involved. Compared to the more advanced countries, especially in the West, the amount spent by the government on agricultural development was very meagre and research as such was, more or less, a very neglected subject.

As I have already stated, more and more attention came to be devoted to this important activity as a result of pressure of events like periodical visitations of famines, etc. and it was not until the Royal Commission on Agriculture made a very comprehensive survey of the situation in India and suggested concrete measures of improvement, that the need for scientific development of agriculture and animal husbandry was felt. I would commend to each of you here to read the Report of the Commission.

One of the important findings of the Royal Commission on Agriculture was that no organization built up without demonstration and propaganda could achieve a full measure of success unless it was based on research; that lack of coordination in agricultural research has prejudicially affected progress; that there was a wide field open for the cooperation of the Government of India and of Provincial Governments in regard to agricultural research and that it was the duty of the Government of India, in the discharge of the elementary responsibilities for the welfare of the vast agricultural population of this country, to advance research in every way possible without encroaching upon the functions of the Provincial Governments in that sphere. After discussing the possible methods by which closer contact might be established between scientific investigators working in Institutions under the Central Government and similar workers employed under Provincial Governments, the Commission recommended

the establishment of a Council of Agricultural Research to which the Central Agricultural Research Institutions and their provincial counterparts would stand in exactly the same relation. The duties of the Council were particularly defined by them as follows :

(a) The promotion, guidance and co-ordination of agricultural and veterinary research throughout India. The Council would not, however, maintain research institutions directly under its control nor would it employ its own staff of experts. It would merely determine whether a particular scheme of research was of all India or of local importance and whether it could best be carried out at an Imperial or provincial research institution or by some other agency such as a University or a private individual and would then, after subjecting the scheme to examination by its expert advisers, make such grant as it considered suitable.

(b) The training of research workers under a scheme of research scholarships or in other ways.

(c) The collection and dissemination of information in regard not only to research but to agricultural and veterinary matters generally.

(d) The publication of scientific papers, etc.

The Commission made recommendation regarding the composition of the Council and how it should be financed. The recommendations were generally accepted by the Government of India with such changes as were necessary in regard to the composition and the finances and the Council was accordingly set up by a resolution of the Government of India in May, 1929. In actually constituting the Council the Government of India, have, in fact, gone a step further than that envisaged by the Royal Commission in that the composition of the Council provides not only for the free association of the central and provincial research workers but also for the close association of the governments of the various States in India who have been allowed to become affiliated members of the Council on payment of a suitable contribution to its funds. In this respect, therefore, the Indian Council of Agricultural Research may be aptly described as a true federation of the various governmental units in the country in the field of agriculture and animal husbandry.

I shall now proceed to give you a picture of the organization of the Council and how it carries its functions. The central organization of the Council consists of two parts, one dealing with the executive functions and the other with advisory functions. The executive part which is known as the Governing Body has the management of all the affairs and funds of the Council subject to such limitations as may be imposed by the Government of India. It consists of the hon. Minister Incharge of Agriculture and Food, who is the *ex officio* Chairman, a principal Administrative Officer, appointed by the Government of India, who is the *ex officio* Vice-Chairman and one representative each from the provinces who will ordinarily be the Provincial Ministers of agriculture ; two representatives of the Legislative Assembly ; two representatives of the business community ; two representatives selected by the Advisory Board and such other persons as may be appointed by H. E. the Governor General from time to time. It is under the last category that representatives of constituent Indian States and other interested bodies are appointed as members of the Governing Body.

The Advisory Body, which is called the Advisory Board, consists of the Vice-Chairman of the Council as the Chairman, two whole time expert advisers appointed by the Government of India, one being a specialist in agriculture and the other in animal husbandry, the Directors of the Indian Agricultural Research Institute, the Indian Veterinary Research Institute, the Indian Institute of Science, and Indian Dairy Research Institute, Bangalore ; the Directors of Agriculture and Veterinary Services or any other nominee from each province ; one member representing the Centrally Administered Areas ; one representing each of these organizations : the Indian Research Fund Association, the Indian Tea Association and the United Planters' Association of Southern India ; one representative of the Cooperative Movement nominated by the Government of India ; one representative elected by

each of the central commodity committees set up by the Government of India or by an act of the Legislature, as the case may be; not more than five non-official members nominated by the Government of India on the ground of scientific knowledge or other special qualifications and such other persons including nominees of the Indian States which have become affiliated members of the Council, as the hon. Minister for Agriculture to the Government of India may from time to time appoint.

The functions of this Board will be to examine the proposals in connection with the scientific objects of the Council which may be submitted to the Governing Body; to report on their feasibility and to advise on any other question referred to it by the Governing Body. In order to carry out its scientific duties efficiently and in planning coordinated research, the Council sets up from time to time certain standing or *ad hoc* committees of the Advisory Board as well as the Governing Body. There are two such types of committees; the first is what may be called commodity committees where for a particular commodity or groups of commodities a compact committee consisting of both scientific experts and representatives of the trade and industry and of producers, manufacturers, and consumers, is set up. The idea in setting up such commodity committees is to take advantage of the advice of the trade and industry and of the producers, consumers and the manufacturers on proposals referred to the Council relating to the commodity or groups of commodities in question. At present the Council has such committees for foodgrains, fibres, fruits and vegetables, medicinal plants, miscellaneous crops, livestock and milk, hides and skins, wool, fish. The other group is called scientific committees which are charged with the detailed examination of proposals bearing on the various agricultural and animal husbandry sciences. These committees usually consist of scientists from Government Departments, non-official scientific workers and representatives of scientific departments of universities. At present there are scientific committees for the following sciences:

Botany, plant pathology including soil chemistry, agronomy and development, entomology, fish, animal diseases and pests, animal nutrition, animal breeding and dairy science. In addition to the above, there are also standing committees for the other activities of the Council: (a) The Publications Committee which examines the matters relating to publications issued by the Council and the promotion of such work by other agencies; (b) the Statistical Committee consisting of eminent statisticians from all over the country which advises on matters relating to statistics as applied to agriculture and animal husbandry.

The setting up of these committees has been particularly helpful in the methodical and thorough examination of all schemes of research and development undertaken by the Council and for satisfactorily coordinating the programmes of research on various commodities and sciences.

The Council's work does not consist of only examining and financing research schemes and watching their progress. The Vice-Chairman is also the principal Adviser to the Government of India on all agricultural and veterinary matters and in this work he is assisted by two whole time Commissioners of the Council and other advisers, e.g. the Statistical Adviser, the Fruit Development Adviser, etc.

The Advisory Board and the Governing Body meet once a year and the Scientific and Commodity Committees also meet once a year some time before the meeting of the Advisory Board so that their recommendations are available to the Board. It will be observed that the organization of the Council is such that it constitutes a forum where administrators and research workers connected with agricultural and animal husbandry development of the country meet periodically for discussion of proposals for research work. These meetings afford a very valuable opportunity to these workers to exchange ideas and gain further knowledge in the interests of their own work. In all these meetings there is no distinction between province and province or institution and institution or State and province or between any one representative and another. In this connection I would like to mention in particular the relation between the Indian Council of Agricultural

Research on the one hand and the Central Institutes on the other. The Central Institutes concerned are the Indian Agricultural Research Institute, the Indian Veterinary Research Institute, the Indian Dairy Research Institute and the Rice and Potato Research Institutes recently set up by the Government of India and the Research Stations of the central commodity committees. The Advisory Board contains representatives of all these bodies and most of the scientific and commodity committees also include representatives from these Institutes. The Institutes are directly under the Government of India but in the interest of the coordinated planning of research in India, the progress reports and technical programmes of these institutes, are referred to the Indian Council of Agricultural Research every year. This makes it possible for the Council to plan its schemes in other institutions in such a manner that overlapping is avoided. It also gives an opportunity to the Council to suggest to the Institutes concerned any new lines of work or modifications in the existing work which are considered desirable from the point of view of the work already being done elsewhere in the country.

As regards the finances of the Council, after considering the recommendations made by the Royal Commission on Agriculture, the Government of India decided that on its formation the Council should be given a fixed initial grant of Rs. 25 lakhs and an annual recurring grant of Rs. 7·25 lakhs of which it was intended that a sum of Rs. 5 lakhs could be devoted to the furtherance of the scientific objects of the Council and the remainder towards the cost of the staff and the secretariat. Since then, however, the annual grants to the Council have been enhanced from time to time. This method of financing the Council was, not however considered suitable and in 1944 it was decided that the Council should be provided with an independent source of income by levying a small cess on the export of specified agricultural commodities. Accordingly, the Agricultural Produce Cess Act was passed that year which provided for the levy of an *ad valorem* export duty of ½ per cent on certain commodities which were specified in the Act. In the same Act it was also provided that a Standing Finance Committee should be appointed by the Council for the purpose of scrutinizing and advising on the Council's financial position and allied matters. This method of providing funds required for the Council has been found to be satisfactory in that it has an assured statutory source of income. But the amounts so realized have not been found to be adequate for undertaking the extensive research proposals, planned by it or submitted to it.

The Council is also in charge of the Board of Agriculture and Animal Husbandry in India which was originally set up by the Government of India as early as 1903. This Board used to consist of all the agricultural and veterinary officers of the provinces and States which had properly organized departments and it used to meet annually to discuss agricultural and allied problems generally and make recommendations. Its recommendations have been acted upon by the Government of India from time to time to the extent necessary. On the formation of the Indian Council of Agricultural Research, the work relating to this Board was taken over by it and in 1935 the Board was split up into two wings, one for crops and soils and the other for animal husbandry. Meetings of these two wings are now held in alternate years. In addition to provincial representatives, these two wings include representatives of research institutions and universities, the cooperative movement and also certain public men who are appointed as members by virtue of their special interest in agriculture and allied matters. The functions of this Board are of an advisory nature but all important problems are freely and fully discussed with it and necessary action is taken by Government on its recommendations to the extent possible.

I have explained earlier that the Council is not intended to maintain research institutions directly under its control or to employ its own staff of experts other than what is provided by the Government in the headquarters establishment. I have also stated that the Council would merely determine whether a particular scheme of research was of all-India or local importance and whether it could best be carried out at a central or a provincial research station or

by some other agency, e.g. a university or a private individual. The application of the results of research in cultivators' fields and developmental work of that type are not ordinarily undertaken by the Council even though according to its constitution developmental work may be financed by it in necessary cases. These activities and research schemes of a purely provincial or local character are usually left to be undertaken by the governments concerned. Accordingly, the Provincial Governments, constituent States, universities and other institutions are invited to forward proposals for initiating research on such subjects of more than local interest and these proposals are scrutinized by the Scientific and Commodity Committees concerned and the Advisory Board. In scrutinizing the schemes, the Committees always have an eye on the proper coordination of work and the avoidance of duplication. In this connection it has recently been decided, as an experimental measure for a period of two years to start with, that in order to avoid wastage and over-lapping of effort, the financing of research schemes should be on a regional basis. According to this system, research work would be classified as fundamental, regional or provincial ; fundamental work as far as possible, would be carried out only at the Central Institutions and universities ; regional schemes would be conducted on a contributory basis by the Council and the governments of the provinces in which the scheme is actually located ; and provincial schemes would be entirely left to be undertaken by the provinces concerned at their own expense. Under this plan it is expected that research work to be carried out in a particular science or on a crop in a region with certain well-defined soil, climatic and other characteristics, would not be repeated in another place more or less having the same type of soil, climatic and other characteristics. For the purpose of this plan, the country has been split up into five homogeneous regions on the agriculture side and four homogeneous regions on the animal husbandry side. The actual description of these regions is practically the same for both agriculture and animal husbandry. The research proposals pertaining to or emanating from each region are examined by a special Regional Committee for that region consisting ordinarily of the Directors of Agriculture or Animal Husbandry, as the case may be, and the Directors of any Central Institutes that may be situated therein, with the Agricultural or Animal Husbandry Commissioners of the Council, as the case may be, as the Chairman. This new plan has so far worked only for a year and actual experience of this short period has shown that this new machinery is useful in avoiding duplication of work. Final conclusions as to the usefulness of this method can however be reached only after it has worked for at least one more year.

Ordinarily, all research schemes are sanctioned on a contributory basis. In other words, when a research scheme is approved for being financed by the Council, it is invariably understood that the Government or the body sponsoring it agrees to meet the entire non-recurring expenditure involved such as the provision of land, buildings, etc. and also half the annual recurring expenditure. This rule is not however observed in respect of research work carried out in these Central Institutes or in universities in which cases the Council ordinarily meets the entire expenditure on all schemes which are carried out at the instance of the Council. Where, however, an Institute submits a scheme on its own initiative, a suitable contribution towards expenditure on the scheme is always insisted on. All schemes are ordinarily sanctioned for a period of not more than five years at a time and are extended thereafter by instalments as required. The actual progress of work under each scheme is scrutinized by the Scientific and Commodity Committees in the light of the approved technical programme and the programme for the next year is also examined in order to ensure that the work is continued on correct lines. Prompt action is taken on the technical remarks by these Committees so as to eliminate defects which are observed from such an examination. Indeed, this system has been found to be very effective and there are a number of instances where on the examination of the progress reports by the Committees it has been found necessary to close down schemes in view of

the unsatisfactory progress of work under them.

At present the Council is financing in all 139 schemes on the agriculture side and 140 schemes on the animal husbandry and 43 schemes on general research and development. The Council has also granted subsidies in 10 cases to journals devoted to agricultural and animal husbandry sciences. The schemes are not sanctioned on any provincial or any other basis but strictly according to their importance. At present there are schemes financed in all the provinces and constituent States and a number of universities.

During its existence for about two decades now, the Council has financed research on a large number of subjects in various parts of the country. Research does not always lead to successful and useful results and in any experimental work, as you will readily agree, one cannot say that certain positive or useful results would be forthcoming. These remarks hold good in the case of research schemes undertaken by the Council but the work carried out by the Council has not been without its useful results either. Both in the fields of agriculture and animal husbandry, some of the research schemes financed by the Council have yielded very valuable results and I shall refer to them briefly now.

On the agricultural side the researches on rice carried out in various parts of the country have led to high yielding varieties, sometimes even as high as 70 per cent increase as in Kashmir. Similarly, work has been carried out on improvement of millets, oilseeds, fruits, potatoes and fodder crops and grasses. In all these cases, not only the yield but also the question of disease resistance and attacks by insect pests, etc. have been tackled. In the case of wheat, work on the elimination of wheat rust and breeding of resistant varieties has been carried out for a considerable time and important observations have been made. A comprehensive scheme for elimination of rust attack has been recently sanctioned by the Government of India and this is to be taken up shortly in view of its importance in the present food shortage. Among other important investigations on the agricultural side, may be mentioned the soil survey, manurial experiments on crops and work on agricultural meteorology. In particular, the manurial experiments on both organic and inorganic manures on a variety of crops under various conditions, provide the necessary data for preparing manuring schedules which are so important in practical agriculture.

On the animal husbandry side, the researches on animal diseases, animal nutrition and animal breeding have led to very fruitful results. A survey of the diseases occurring in India has been made possible entirely on account of the Disease Investigation Officers and Assistant Disease Investigation Officers provided by the Council and this has led to the definition of various diseases and methods of overcoming them. The work on animal nutrition has led to very useful results such as the enhancement of the feeding value of rice straw by washing, the use of fish-meal and bone-meal and other by-products as a source of protein concentrates, the advantages of controlled grazing, the methods of saving food and the augmentation of the country's feeding resources and requirements. In cattle breeding, the immediate advantages occurring to the farmers from the work of the Council are the availability of approved sires and reliable breeding stock, enhancing their usefulness by artificial insemination, improving the quality and quantity of wool by selective breeding in the plains and cross breeding with Merinos in the uphills, means of increasing milk supplies from goats by upgrading with superior indigenous breeds, etc. Work on poultry diseases has also been undertaken and an important achievement of the Council in this line is the discovery of a vaccine for the Ranikhet disease of poultry which has eliminated huge losses among poultry in India. This vaccine is in great demand even in other countries.

Similarly, on the dairying side also, useful research work has been carried out. The chief results of practical importance obtained so far are the production of vegetable rennet, means of manufacturing edible casein and lactose on a cottage industry basis ; manufacture of rennet casein under village conditions ; method of neutralizing high

acidity of *ghee* with common lime ; manufacture of a simplified and improved *ghee* boiler and village utensil steamer ; simplified method of testing fat in milk and standardizing sesame oil test for detecting adulteration of *ghee* under Indian conditions.

Apart from this, a number of very useful schemes have been worked by the Council bearing on fish and fisheries, apiculture and hides and skins.

I would have liked to tell you in greater detail some of the interesting observations and the useful results from several of these schemes but limitation of time makes it impossible for me to do so. I would however be glad to give full particulars of some of these activities to those of you who desire to have more particulars at any time.

One of the important activities of the Council is the publication of scientific journals, bulletins, monographs, etc. These journals and other publications include not only scientific articles on the work done under schemes financed by the Council but also those on research work carried out by scientists in India generally. The following quarterly journals are published at present:

1. *Indian Journal of Agricultural Science.*
2. *Indian Journal of Veterinary Science.*

The above are scientific publications. As a means of making available to the common man in popular language the results of scientific work done in India whether under the Council's auspices or otherwise, the Council has started an English monthly called *Indian Farming* which most of you, I am sure, would have seen. A translation of this in Hindi called *Kheti* has also been started for the benefit of those who are unable to read English. These two journals contain up to date information bearing on agriculture and animal husbandry and are in great popular demand.

Scientific monographs and miscellaneous bulletins are published by the Council, as and when required, on individual subjects. Up to the present time it has published 16 scientific monographs and 67 miscellaneous bulletins. Several more are ready for publication but owing to difficulties in printing, they have been held up.

In view of the importance of the application of modern statistical technique in the planning of field experiments and the interpretation of data, the Council has strengthened its special statistical staff considerably during recent years. At present it has a Statistical Adviser, assisted by a number of Statisticians and Assistant Statisticians and other technical staff whose time is mainly devoted to rendering advice on the statistical aspects of all research schemes referred to the Council including their lay out and analysis of data. In this connection it has been found necessary to start training courses on modern statistical methods under the auspices of the Council, for the benefit of the Central and Provincial Governments. There are three courses at present, the first one is an Application Course for the ordinary workers under research schemes ; the second is the Certificate Course which extends over one year and is a highly advanced course and the third the Diploma Course which is a continuation of the Certificate Course. According to the present arrangements, there is provision for training about 15 persons in the Application Course, 20 persons in the Certificate Course and 10 in the Diploma Course.

One of the Council's objects is to maintain an up to date scientific library. Accordingly, a library has been built up and at present it consists of nearly 70,000 volumes exclusive of various journals and other scientific publications from all over the world. Several of these publications are obtained on an exchange basis but a large number of them are also purchased out of the research funds of the Council. The library is located at the Indian Agricultural Research Institute and is available for the use of all scientific workers. I would suggest a visit before you leave Delhi.

The necessity for examining the research policy of the Council and the changes that may be required therein, have been examined on a few occasions in order to ensure that the Council's work proceeds on right lines. In this connection I would like to tell you about one very important review undertaken as early as 1935 by two very eminent scientists from abroad, viz. Sir John Russell of the Rothamsted Experimental Station and Dr N. C. Wright of Aberdeen. These two experts went deeply into the work and activities of the Council and the Provincial

Departments and made a number of important recommendations as to the lines on which the Council should lay out its work for the future. Their review of the position then existing and the suggestions made by them for the future, were appreciated by Government and effect has been given to their recommendations to the maximum extent possible.

A similar review, but on a departmental basis, was carried out last year by the expert advisers of the Council after personally visiting all the research schemes financed by it. A small committee was appointed for the purpose of reviewing the progress and suggesting plans for the future. As a result of this review also, the Council has modified its research programme wherever necessary. Such periodical reviews will be undertaken in future as well so as to ensure that the work of the Council proceeds on the right lines.

Though the Council has done a good deal of work during the 20 years of its existence yet what we have covered is only a fringe of the problems involved. To keep pace with the advanced western countries we have to go very far. Indeed, until production in the country is up to the required level and the national nutrition and the standard of living of the people are also raised to the required extent, our energy and resources will have to be utilized to the maximum possible extent. With this object in view, a detailed memorandum was prepared in 1944 as a part of the post-war development plans. That memorandum revealed that the reconstruction of Indian agriculture was a colossal problem in that a very large expenditure would be involved not to speak of the technical talent that will be necessary. Agriculture cannot be considered as an independent entity and its development is part of the larger problem of rural development which must be tackled as a whole. The plan prepared in 1944 took all these factors into consideration but owing to various circumstances it has not been possible to give effect to any reasonable part of it so far. To mention in broad outline the problems we have to tackle, there is the question of water supply for agricultural improvement. Our existing resources of water supply have to be utilized to the best advantage by developing irrigation, the use of subsoil water, control of erosion and allied matters. Then comes the utilization of the land—to bring under cultivation the maximum additional land out of what has been classified as unculturable waste and fallow ; to prevent erosion ; to provide a schedule of cultivation to the farmer which would be suitable to his land and individual needs ; to advise the farmer regarding the attainment of higher crop yields by improving methods of husbandry, better seed, improvement of cultural practices and the control of insects and pests. Experimental work on proper manuring of land has shown that the yield per acre can be increased easily by 20 per cent. Use of improved varieties of seed would give easily an additional yield of 5 to 10 per cent and in this manner can be shown how by improvements in the various directions, which have been mentioned, it would be possible to increase the general yield of crops all over. Similarly, on the livestock side, adequate supply of fodder of the required type and controlled breeding of pedigree animals is a matter which required greater attention. Here too, the prevention of disease and improvement in village management are most important.

All this involves intensive research and the application of its results on a very wide scale throughout the country. Without timely incorporation by the cultivator of the useful results in his everyday practice, research work alone will be futile. In the plan I have referred to, this aspect of the matter has been given very great attention after a comparative study of the machinery available in advanced countries for achieving this end. The proper handling of these vast problems requires the setting up of a federal organization for which the present set up of the Indian Council of Agricultural Research can be considered as a miniature. This federal organization must have adequate funds and authority to carry out its programme both by its own direct efforts as well as through provincial agencies. The provinces themselves will therefore have to spend a great deal of money and effort to work the plans successfully. Considering the vast expenditure involved and the technical talent that is essential, it is too much to

expect that we shall be in a position to attend to all that has been found wanting but it is still essential to keep these plans in view in laying out our programme of development in future.

The Indian Council of Agricultural Research has done its bit with its slender resources towards promoting research, co-ordinating the work done in the country and disseminating knowledge for the benefit of the people at large but its existing organization requires vast improvement. The existing technical talent in the country has to be utilized fully and a continuous stream of trained persons should be available to keep the work going at full speed. As experience of advanced countries will be invaluable especially in certain directions, e.g. organization of extension services, disease control and the like, the Government of India have, in connection with their technical training scheme, trained a larger number of persons and the valuable knowledge gained by them has to be fully utilized. All these matters require very careful attention. I hope that as district officers and administrators in charge of important development work in the provinces and States, you will give your whole-hearted attention to the problems I have briefly stated, so that the sons of the soil may emerge forth into a happy and contented nation blessed with all that nature can give them. If time permits I shall be glad to answer any question that you may like to ask.

Original Articles

A REVIEW OF SOIL WORK DONE IN UTTAR PRADESH WITH PARTICULAR REFERENCE TO CROP PRODUCTION

By R. R. AGARWAL

THERE are in the Uttar Pradesh three distinct tracts differing from one another in their geological formation and other characteristics. These tracts are :

(a) The Hill tract in the north
(b) The Bundelkhand tract in the south
(c) The Ganga alluvium in the centre

Work on the soils of these three tracts has been in progress chiefly on pedological principles and the main object has been to study the condition or set of conditions that influence the yield and quality of crops growing in these regions. A number of manurial trials on the soil types characterized in some of the regions of the tract was also laid to study the manurial requirements.

A brief summary of the more important results obtained so far from these studies is given below tract-wise.

Hill tract in the north

The investigations were started in 1934 at the Soil Chemistry Section of the Hill Fruit Research Station at Chaubattia, Ranikhet under a scheme partly financed by the Indian Council of Agricultural Research.

There are principally two rock formations in Kumaon Hills of Uttar Pradesh which are important from the standpoint of soil formation. They are biotite schists and phyllites. Soil formed from both these differ fundamentally. On an average, it has been found that biotite soils are poorer in phosphates and richer in potash than the phyllitic soils and consequently manuring with phosphates has always given good results in biotite zones.

The soils of the locality irrespective of the nature of rock formation can be divided into three important genetic soil types, viz. (i) brown forest soils, (ii) podsolic soils, and (iii) wiesenbodens or meadow soils[1]. Under terraced conditions brown forest soils are stable, whereas podsolic soils tend to assume characteristics of brown forest soils. The data indicate superior inherent fertility of brown forest soils as judged by the distribution of organic matter, lime, total and available phosphorus and potash and exchangeable calcium. Due to high acidity and deeper eluviation of nutrients in podsolic soils the plants cannot flourish so well on these soils as on brown forest soils. Wiesenboden soils are found under water-logged conditions.

Soil survey work was also started on some of the important commercial orchards in the hills with a view to give the owners advice regarding the prevailing soil conditions. The nature and characteristics of soil types studied on these orchards were almost similar to those found at Chaubattia. In general, the soils are acidic and need liming together with some form of phosphatic manures. Proper moisture conservation was another factor needed for successful fruit cultivation.

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[1] Mukerji, B. K. and Das, N. K. (1940). *Indian J. Agric. Sci.*, **10**, 990-1020

Soil conditions and differential behaviour of fruit trees

From the detailed soil survey data it was found that soil condition influenced productivity, heavy loam brown forest soils and heavy humus-podsols and are best suited for growing apples. Iron podsols and hard clay soils, sandy-stony soils and sandy loam brown forest soils were considered to be very inferior for this purpose. Similarly for peach, apricot, plum and cherry sandy-loam soils were considered to be better. Further detailed study of yield data showed that vigour of fruit trees was largely dependent upon the moisture status of soils, all well-formed trees being generally found in areas where the soil has a good moisture-holding capacity. Considerable correlation has been found between the soil condition and the incidence of diseases and insect pests of fruit trees. For instance, the apple root borer is more serious on soils which are sandy and dry. Similar observations have been made in regard to pink disease and root and collar-rot of apple plants.

Bundelkhand tract in south

The part of Uttar Pradesh lying south-west of the river Yamuna is known as Bundelkhand. The tract is non-alluvial in nature and the soils have been formed by the disintegration of the rocks of the Central Indian hills. Geologically the whole of Bundelkhand is occupied by gneiss and some of the beds are highly ferruginous. Sandstones, limestones and slates are also found but these usually rest on the underlying beds of gneiss. The climate is exceedingly dry. Soil work in this region was started in 1941 and continued till 1946.

Three genetic soil types have been recognized in this tract which have been termed as Bundelkhand type I, Bundelkhand type II and Bundelkhand type III. Type I is a reddish brown coarse-grained soil very shallow in depth. This is underlaid with the parent undecomposed material. The soil is very poor in colloids and in plant nutrients and is of an open texture allowing free drainage of water. No good cultivation is possible on this type of soil. This type is found on high-lying areas. Type II is found on milder slopes or on comparatively level plains. This has got a brown colour and varies considerably in texture. It is possible to find a sandy, loamy or clayey sub-type. The soil has a greater depth and is usually underlaid with a zone of calcium carbonate accumulation in the form of *kankar* layer. This type is suited better to cultivation provided manuring and irrigation facilities are available. Type III is the clayey type found usually in low-lying areas and in plains. This is also calcareous and dark brown to jet black in colour. These soils which are formed under restricted drainage are by far the most fertile soils of the locality[2].

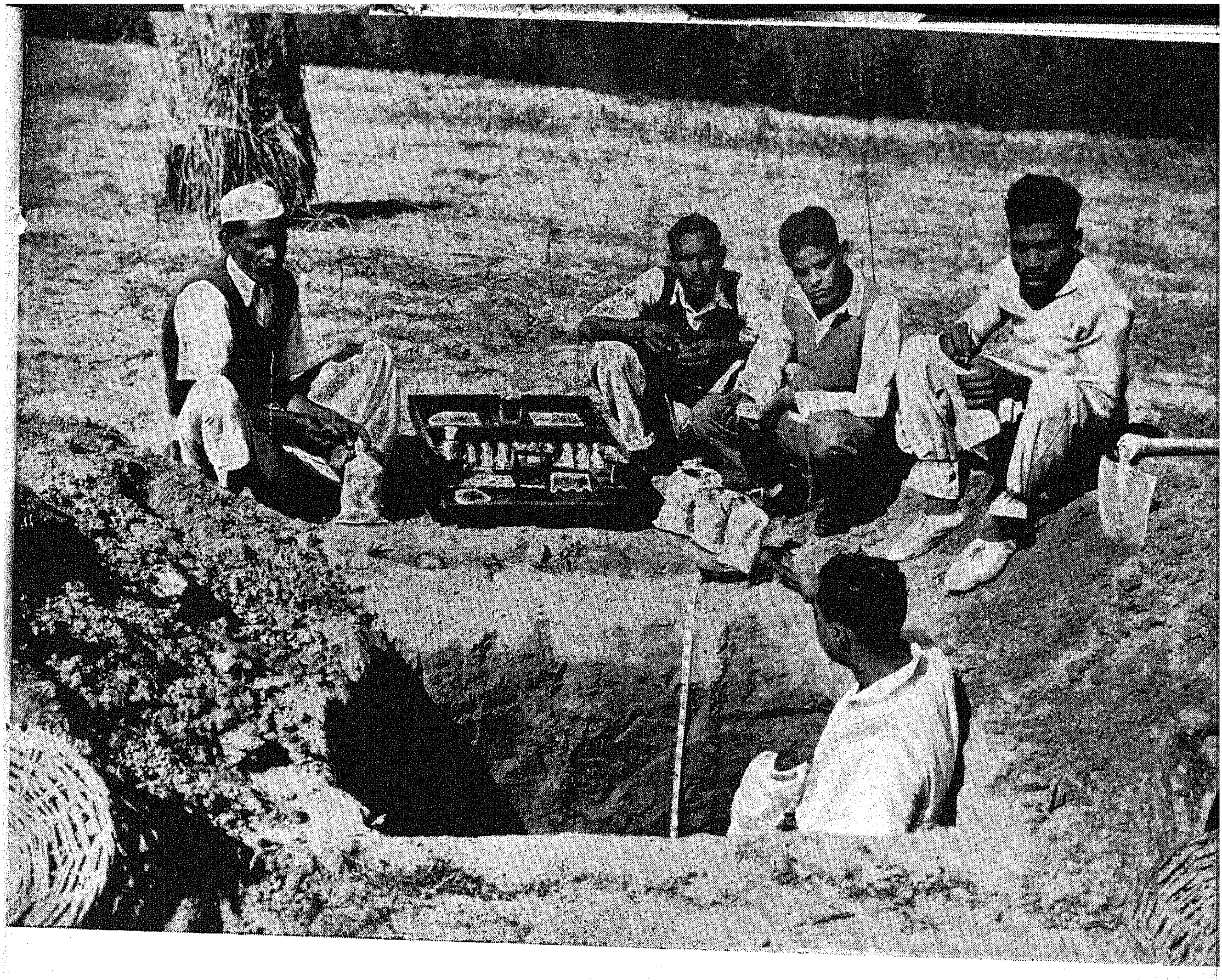
Yet another type of soil, not fundamentally different from type III, occurs in the extensive plain areas of the region south-west of Kanpur mostly in the district of Jalaun[3]. This type is known to constitute the most fertile soil of the locality. Morphological examination did not reveal any distinct variation from the type III already described excepting that the structure of the profile of plain soils was more crumby. The soils were found to be poorer in sodium content as compared to type III soils. The soils were on analysis found to be poor in coarse sand and contain from 40 to 50 per cent clay in the top layers. They are fairly well-supplied with nitrogen and potash but are average in phosphorus. The pH is alkaline due to the presence of lime. The exchange capacity was found to be fairly high.

The three genetic soil types described above have distinct crop adaptabilities. Type I is suited for very inferior type of crops like *til* in the *kharif* and gram in the *rabi*. In type II soils *jowar* is cultivated in the *kharif* and gram in the *rabi*. The cultivation of wheat or linseed is possible only in type III soils.

Methods of dry farming as suited to the three soil types including preparatory tillage operations, *bunding* or mulching, etc. are in the course of investigation. It has been tentatively found that shallow ploughing coupled with *bunding* the fields give increased yields of crops in type I and type II soils.

[2] Mukerji, B. K. and Agarwal, R. R. (1943). *Indian J. Agric. Sci.*, **13**, 587-598.

[3] Agarwal, R. R. and Mukerji, P. (1949). *Indian J. Agric. Sci.*, **19**, 31-39.



A soil survey party at work.

PLATE 24

Gangetic alluvium in the centre

The soils in this tract have been formed as a result of the deposits laid down by the river Ganga and its tributaries. The tract is a vast region occupying the whole of the central Uttar Pradesh. The differences in soil characteristics are mainly climatic and on the basis of such considerations the Ganga alluvium of Uttar Pradesh has been divided into a number of distinct soil-climatic regions. Soil work has been done during 1940-44 only for the following areas :

(1) Unnao and Hardoi districts.
(2) Gorakhpur and Deoria districts.

Unnao and Hardoi districts

The soils of Unnao district show characteristic of sodium soils. The types so far met with are (a) immature salty-alkali soils, (b) salty-alkali and (c) degraded salty-alkali soils[4]. The first type is usually found in *tarai* (low-lying) areas and is generally light loam in texture. The colour is more or less ash-grey. These do not constitute very fertile soils since cultivation is usually precarious due to periodic inundations. Salty-alkali soils cover by far the major portion of the tract. The texture is generally sandy loam at the surface succeeded by a layer of clay in the bottom. The soils are grey in colour and of average fertility. These occur with or without a *kankar* layer. Degraded salty-alkali soils are the leached soils showing reddish-yellow colour and sodium action is practically found absent from the top layers. They are of an open texture and contain exchangeable sodium in large amounts in the sub-soils only. A regional map of the district showing the distribution of the soil types was also prepared.

Data obtained for Sandila *tehsil* in particular and for the Hardoi district in general, have furnished some very interesting results in regard to the soils of the locality[5]. It has been found that the soils bordering the river Gomti towards the north-eastern part of the district are highly sandy in texture, the chief chemical feature being the high sodium content both in the soil solution and the exchange complex. The soils are devoid of calcium as well as plant nutrients and in consequence support only poor types of crops. The soils of this tract, however, slightly improve in texture towards the south-west. The better classes of land in this soil type grow wheat and barley in the *rabi* and *arhar* and *jowar* in the *kharif* ; but on lighter classes only a mixed crop of *arhar* and *jowar* or *bajra* is possible. Bordering this zone there is a broad strip of low-lying land in the central part of the *tehsil* where the soil has become alkaline and due to imperfect drainage the landscape is found disfigured by large stretches of usar (alkaline soils). Here the chief crop is paddy in the *kharif* and barley or gram in the *rabi*. Beyond this area the soil again becomes medium loam. On the western part of the *tehsil* the belt of land on either side of the river Sai is of good fertility and the soils of that area are still rich in calcium having a good drainage since sodium has not so far produced a harmful effect. These soils usually grow sugarcane, wheat and barley with *jowar* as the main *kharif* crop.

Gorakhpur and Deoria districts (sugarcane soils)

Gorakhpur and Deoria happen to be two of the main sugarcane growing districts of the province and the work has been concentrated in these districts since 1942 with a view to understand some of the fundamental changes that might be undergoing in the soil as a result of intensive cane cultivation. The main factors under study have been the chief manurial requirement of the crop under different cultural and irrigational practices, the selective adaptability of the improved varieties to soil types, the suitability or otherwise and the dosages of artificial fertilizers, etc. The final aim is to find what set of treatments produce maximum yield of cane in relation to long term soil usage.

It has been shown as a result of an intensive soil survey that the soils of Gorakhpur and Deoria districts can be divided into the following main three types :

(a) Calcium soil with a large reserve of lime (type I).

4 Mukerji, B. K., Agarwal, R. R. and Mukerji, P. (1946). *Indian J. Agric. Sci.*, **16**, 263.

5 Mukherji, B. K. and Agarwal, R. R. (1947). *Indian J. Agric. Sci.*, **17**, 1-13.

(b) Leached calcium soil with a layer of calcium carbonate in nodular form (*kankar*) at the bottom (type II).

(c) Degraded calcium soils in which the calcium in the exchange complex has been partially replaced by hydrogen (type III).

Quality and yield of cane as affected by soil types

In order to study the differences in the performances of different popular sugarcane varieties as affected by the three soil types enumerated above, a number of crop-cutting experiments were conducted on cultivators' fields. The juice was also analyzed for quality. Briefly the data indicate that Co. 356 suits type I soils, Co. 370 suits all the three types and Co. 421 type III best. Amongst the early varieties the indications are that Co. 395 suits type I and type III and Co. 393 type II soils. Co. 313 has given a poor performance throughout so far as the cane yields are concerned but a good sucrose content in cane was obtained, although not as good a purity as compared to the other early varieties.

Manurial requirement of cane as affected by soil types

Manurial trials with all combinations of three levels of nitrogen and three levels of phosphoric acid were conducted on each of these soil types. They were conducted for four cane seasons on cultivators' fields in close cooperation with the staff of the sugar industry.

It is interesting to note that a considerable increase in the yield of sugarcane can be obtained by liberal nitrogenous manuring in type I soils and phosphatic manuring does not appear to be necessary. In type II soils on the other hand, besides manuring with nitrogen a supplement of about 40 lb. phosphoric acid per acre has been found to be beneficial for crop production. In type III soils phosphoric acid application is unnecessary and nitrogen application over 60 lb. per acre did not produce significantly higher yields, but an application of lime appears to be beneficial in addition to nitrogen.

ERRATA

Indian Farming, Vol. X, No. 12, December, 1949 :

Page 546, col. 1, line 2 from bottom, *for* ' Aduthuria ' *read* ' Aduthurai.'

Col. 2, line 3, *for* ' former ' *read* ' latter.'

EARLY *KHARIF* FODDER CROPS IN IRRIGATED AREAS OF THE PUNJAB

By RATTAN SINGH and H. C. MALIK

IN an agricultural country like ours, which for the cultivation of its lands and for its milk supply has to depend upon its cattle, the maintenance of cattle wealth, which is a national asset, in a satisfactory manner, becomes a primary charge on the farmer. In addition the cattle are responsible for the production of enormous amount of farmyard manure, which is used for the maintenance and enhancement of soil fertility. Therefore in order to keep cattle in good condition, production and supply of green fodder, which, by the way, is comparatively much more nutritious, having an abundance of the essential food factors like minerals, vitamins, etc., preferably continuously throughout the year, is absolutely necessary. Therefore, any measure calculated to improve the live-stock, either for milk or for draught, can only be successful if, among other things, a continuous stream of green fodder, in adequate quantities, is available.

Shortage of fodder

Usually there is no dearth of green fodder in the irrigated areas during the main *kharif* and main *rabi* seasons. But even then the cultivator invariably experiences shortage of fodder in the two transitional periods in the year, i.e. in the early *kharif* period from the end of April to the middle of June and in the early *rabi* period, i.e. in October-November. In the former period crops like, berseem, oats, begin to dry up with the advent of hot season; crops like *jowar*, *guara* and *moth* are yet to be sown. So it is during this period, when the dry stalks of *bajra*, *jowar*, etc. and by-products of *rabi* crops as for example, *bhusa* of wheat, very little green fodder can be obtained. Lucerne may be able to supply some green stuff, but it is not grown everywhere, particularly in the humid areas, and also it is not considered suitable for feeding to milch animals. Grazing is also out of the question, because the grasses in the so-called grazing grounds around the villages are dry. They sprout only with the monsoon rains and are usually available for grazing in July-August. Early rains are seldom precipitated in sufficient quantities to allow the grasses to grow luxuriantly and become fit for grazing.

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Improvement of fodder crops

With the inception of the Fodder Research Section of the Agricultural Department, work on the improvement of fodder crops has made sufficient progress. A number of new crops has been introduced. Improved strains in the existing crops have been evolved. Both these can supply enough forage to overcome shortage during the intervals of cropping seasons mentioned above. The object of writing this note is to acquaint and remind the zamindars of the desirability of selecting and sowing in appropriate time some of the crops, mentioned below. Cowpea No. 1, Sudan-grass and Teosinte are some of the examples of introductions, while maize and *jowar* selections are from among the existing crops. It will be in the interest of farmers to know something about each of these crops so that they can select anyone which suits them best. A short description of these crops is given below.

Jowar

Jowar is the premier fodder crop grown universally both in irrigated as well as in *barani* areas. Following new types have been evolved and are recommended for cultivation.

No. 20 : It is a non-sweet, tall-growing and

thin-stemmed variety having lax ears and brownish-coloured grains. It yields as high as 500 md. of green fodder per acre. It makes very good *karbi* (dry stalks) which can be safely stored for longer periods.

No. 263 : It is a sweet selection and hence provides sweet and succulent green fodder. It gives from 500 to 600 md. of green fodder per acre. It has dense ears with plump, creamy white grains—so good for human consumption. It is both a high fodder and high seed-yielding variety.

Sown in the end of March, with a seed-rate of about 20 seers per acre, the crop is ready for feeding in about 70 to 75 days. No. 20 becomes ready earlier than No. 263.

Maize

Maize as a fodder is extensively grown in the central districts of Jullundur, Ludhiana, Amritsar and Gurdaspur where the climate is comparatively mild and humid because of the high rainfall in these areas. As a source of supply of green fodder both in early and in the main *kharif* season the crop is generally grown either alone or in mixture with *jowar* both in the urban and rural areas. Sown in March, the fodder is available in May, i.e. within 50 to 60 days of sowing. Ten to twelve seers of seed per acre is used for this crop. Two irrigations are enough for the crop to become ready which supplies about 250 to 300 md. of good, nutritious green stuff per acre.

Maize is admirably suited for growing in mixture with Cowpea No. 1 as both of these take the same time to become ready for fodder and the mixed crop provides one of the most nutritious and balanced feed for the livestock.

Cowpea

Cowpea is not a pea but a bean except that it has long vines and tendrils with broader leaves and bolder seed than those of the local beans. It was introduced from abroad and Fo. S. No. 1, a selection from it, has adapted itself to our climate admirably well.

It is a quick-growing, excellent leguminous forage adapted to all kinds of soil provided they are well-drained. Cowpea is a highly restorative crop, adapted to the same climatic conditions as maize and thus it is usually grown mixed with it, with which it forms a very nutritious and balanced feed.

To get early fodder during May-June, cowpea is sown in the middle of March or as soon as the season is warm enough, using 16 to 20 seers seed rate per acre.

The crop requires first irrigation in about three weeks' time after sowing and is ready for fodder in about 70 days. It yields 250 to 300 md. per acre of green fodder on good, average soils. As mentioned above, it can be sown mixed with other non-legumes, such as maize, *jowar* and Sudangrass. However, maize-cowpea mixture is the best, because it provides higher yields of nutritious green fodder.

In addition to yielding good fodder, green pods of cowpea serve as good vegetable for the table.

Sudangrass

Sudangrass is another new fodder with slender leafy stems introduced and recommended for cultivation in the province only recently. It resembles *baru* grass (*Sorghum halepanse*) in its vegetative characters but differs from it in its root system. *Baru* is a perennial weed with underground rhyzomes, while the Sudangrass is an annual with ordinary fibrous root system. It grows about 6 to 8 feet high having stem of 3/16 inches in diameter. It is closely related to the cultivated sorghums but differs from them in its ability to tiller.

Sudangrass favours warm climate like *jowar* and, in favourable season, as many as four cuttings can be obtained during the growing period. It can withstand drought also. High yields of green fodder are secured under irrigation on rich loamy soils, but it can do well on other types of soil also.

Sudangrass may be sown broadcast or by *kera* using about 10 to 12 seers seed-rate per acre. The crop can be sown from the middle of March onwards till the end of July. Early-sown crop is ready in about 50 days in May and provides green fodder when there is a great scarcity of it. In all, two irrigations are enough to enable the crop to become ready for the first cutting of green fodder. Later on, irrigations after every fortnight give good growth of the crop. About 150 md. of green fodder

is obtained in the first cutting. A total yield of more than 400 to 600 md. per acre is obtained in four cuttings during the growing season. Since it remains in producing condition till the end of November, it continues to supply green fodder till that time, so that the gap of October-November also, as mentioned above, is bridged over.

Teosinte

It is also a new crop introduced, acclimatized and now recommended for cultivation in the province. It is considered to be the wild ancestor of the cultivated varieties of maize from which it differs in its ability to tiller and in its female inflorescence. It does well under the same conditions in which maize is cultivated and, therefore, has been satisfactorily grown particularly in the central districts such as Jullundur where rainfall is good.

Under irrigation, where early sowings in March and April are possible, two or three cuttings of green fodder are secured, the first one being available in May or June, depending upon the time of sowing. Soil must be rich and irrigation liberal. If sown late, i.e. in the end of July or the beginning of August, the crop is ready for fodder in October-November, when there is again shortage of green fodder. Heavy yields of green fodder about 400 md. or more, have been obtained by using 16 seers seed-rate per acre.

> Rear your stock well.
> Breed only from stock which are the progeny of healthy productive stock, and which are the result of a normal gestation.
> Do not overload the sire.
> Give adequate rest between pregnancies.—*Australian Agricultural Newsletter*, No. AGN/288.

METHOXONE AS AN ERADICATOR OF THE WEED, *PLUCHEA LANCEOLATA*. (VERN. BAISURAI)

By T. N. SHIVAPURI and B. P. TYAGI

THE importance of weed control need not be over-emphasized as it has been repeatedly pointed out that millions of acres of land have gone out of cultivation on account of weed infestation.

Equal in importance to *kans* is *Pluchea lanceolata* a very noxious, perennial, xerophytic weed, which cannot be eradicated by common tillage practices or hand hoeing. Soon after the weeding is done, it makes its reappearance within 25 days or so.

Botanical studies

Detailed botanical and anatomical studies made on this weed, clearly show that it passes through two distinct phases of development during the year according to different seasons. The weed plant is seen sprouting in the fields and culturable waste lands in the month of October, starts bud formation towards the end of December, which flower by February-March.

The seeds are produced in large number which are disseminated by wind. This phase continues till the beginning of the rains. It may be called the 'normal flowering phase' of the plant. With the onset of the rains the flowering phase of the plant starts withering and all the fields, which looked green during the summer due to this weedy vegetation, seem to have been cleared off. But, when the underground parts of these withering plants are examined, they are found to be definitely alive in their roots which give rise to new shoots. This phase of the plant may be called the 'vegetative' phase, which lasts only for a period of three months, till the end of the rains. The root system in *Pluchea lanceolata* is characteristically of two different types :

1. Vertical root system in which the tap root goes deeply penetrating into the ground. At Kanpur, its tap root system has been traced up to a depth of 25 feet.
2. Horizontal root system in which the root trails along the surface, giving rise to new shoots at regular intervals.

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Field experiment

In order to test the efficacy of the plant hormone Methoxone as an eradicator of *Pluchea lanceolata*, a field where this weed was found growing in a wild state was selected and sub-plots of convenient size were laid out. Two sprayings at an interval of a fortnight were done on a two-month old weed crop with solutions of different strengths on clear evenings with a common bucket sprayer.

Results

Spraying with four pounds of Methoxone as four gallons of 10 per cent liquid 'Agroxone' in 100 gallons of water per acre, arrested the growth of the plants. Stem and leaves became twisted and contorted ; the foliage changed colour to light brown. No sooner the second spraying was done than the plants started dying and within three to four weeks all the plants succumbed to the injury caused by the plant hormone.

Similarly two sprayings with 0·2 per cent Methoxone brought about 75 per cent of deaths.

Sprayings, even with lower dilutions, caused marked epinasty of the foliage and partial withering of the plants.

Conclusion

Two sprayings with four gallons of 10 per cent 'Agroxone' in 100 gallons of water per acre are enough to completely destroy the weed. It is possible that only one spraying, if given, at the right time may be equally efficacious.

IRRIGATION PROJECTS IN MALABAR

By P. V. C. RAO

MALABAR gets an annual rainfall of 100 to 140 inches. Excepting the coastal strip, its landscape is undulating and cut up, as a result of which most of the rainfall is lost as runoff taking tons of erosional debris in swift currents. There are rich coconut gardens in the coastal belt, and the interior hill slopes carry extensive coffee and tea plantations. During the last decade or two, the hill sides were cleared of the forest cover for the growth of these plantations. Lands were leased out indiscriminately. The Nilgiris now present a gruesome appearance with bare hill sides badly mauled by gullies. The overhanging treeless slopes are becoming heavy with the penetrating precipitation, and landslides have become the order of the day.

Poverty amidst plenty

Erosion and runoff have thus been emasculating Malabar, notwithstanding its heavy rainfall, good soil and tropical climate. It stands as a striking example of poverty amidst plenty. Attempts have been made during the past years to plan irrigation projects in this area, but the natural handicaps in harnessing streams flowing through mountainous regions, and canalizing water flow through undulating countrysides, have been rendering the schemes uneconomical when measured with the yardstick of minimum return on capital outlay. But the need of the hour is to increase production irrespective of adequate return on capital outlay, and therefore the yardstick has rightly been discarded. Altogether 60 irrigation schemes, major as well as minor, are now planned of which Malampuzha is the major one estimated to cost about Rs. 380 lakhs and will irrigate 63,500 acres. The cost of construction of this and other projects varies between Rs. 600 and Rs. 1,500 per acre.

Another reason as to why flow irrigation projects have not been encouraged before in this district is the consideration that, unlike the precarious rainfall areas, this district with its heavy rainfall spread over 8 to 10 months in the year should not feel any dearth of water for its agricultural purposes. This notion held good so long as the forest on the hills held a modulating influence on the mountain streams and preserved the top soil from runoff. But when the hills were uncovered, the position changed completely and the heavy rainfall is now acting as a destructive agency instead of assisting the crop growth.

An identical area will be found in the Agency tracts of Vizag and Koraput districts. The hills are heavily denuded due to the indiscriminating type of shifting cultivation, popularly known as 'podu' and the heavy rainfall of over 50 inches has been devastating the hillslopes as well as the rich valleys. The area is sparsely populated by hill tribes who have been spoiling the land through their primitive modes of cultivation. The Araku valley is situated in the midst of this area, and settlements are now proposed to be established through the usual methods of dry cultivation on the sloping valley beds.

Master-plan of land utilization

The Tennessee Valley in the U.S.A. stands as a unique example in the planning of what is called 'natural irrigation' in heavy rainfall and undulating countrysides. The Valley gets over 100 inches of rain which is admirably harnessed through a master-plan of land utilization based upon effective measures of soil and moisture conservation including protected drainage-ways for surplus rain disposal. The alignment of utilization and production technique of the Valley land is as regular and effective as its mass production planning in its industrial units. In the Valley every inch of rain and every acre of land are made to fit in a controlled pattern of land economy.

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The result is that they do not feel the necessity of utilizing even one of its multifarious dams for diverting water for an 'artificial flow irrigation'. They found by experience that without the necessity of incurring heavy expenditure on a network of irrigation canals through undulating countrysides, the heavy rainfall the region gets may be utilized for crop production through a system of localized natural irrigation. Under this system all slopes exceeding 10 to 15 per cent in gradient and waste lands are reserved for farm forests and grass growth which supply the requisite fuel and fodder to the villages. Thanks to the heavy rainfall in Malabar, the majority of such areas should get natural vegetative cover by mere reservation, but wherever the hills have lost most of the top soil through unchecked denudation and continuous runoff, it will be essential to give mechanical protection through contour trenching, check dams, groynes, etc. for the slopes, and carry out regular plantation work. Slopes less than 10 to 15 per cent in gradient should be contour-bunded or terraced with suitably designed drainage channels. Contour tillage assists further conservation of moisture. Under such a system of localized irrigation, the rain is conserved and utilized wherever it falls. When each valley is treated as a unit of operation in this manner, the subsoil water-table of the valley comes up and crop growth is accelerated through the perennial sub-surface flow. Wet crops can be grown on lands which are normally classified as 'dry', with the assistance of the sub-surface flow irrigation. More springs will be available for paddy cultivation. Extensive fruit cultivation will be possible through small farm ponds, springs and wells in which perennial supply of water will be available at a few feet deep from the ground level owing to the raised subsoil water-table. Such a phenomenon has been noticed even in the precarious rainfall tracts of Bombay Carnatic where extensive conservation farming measures have been undertaken.

It is through such a coordinated system of 'localized irrigation' and conservation farming, assisted by a variety of mechanical implements, that the TVA has been carrying on its agricultural industry. There is no reason why we should not adopt similar measures on identical areas in our country and secure more speedy and economical results than what the traditional type of flow irrigation projects would allow. If we take immediate steps towards this end in the heavy rainfall areas like Malabar and the Eastern Ghat Plateau of Vizag and Koraput districts, as well as the drought-affected areas like the Deccan Plateau and the Central Indian Plains, we can attain self-sufficiency in food with certainty by 1951.

FEEDING OF FARM ANIMALS

By LAL CHAND DHARMANI and KARTAR SINGH LOHARA

UNDERFEEDING impairs the health of animals, whereas overfeeding strains the animal system and is wasteful. Therefore in order to feed the farm animals adequately and economically it is essential that the ration of the farm animals should be regulated both in quality and quantity. This entails the use of properly balanced rations by which the animal is supplied in its daily diet with the proper amount of all the food constituents necessary to ensure a steady production of weight in the case of young growing animals, milk in the case of milch cattle, energy in the case of working animals, and to ensure a state of maintenance when they happen to be dry or doing no work.

Constituents of foodstuffs

The important constituents of foodstuffs are proteins (meat-like substances), fats (fatty and oily substances), carbohydrates (starchy and sugary substances), mineral matter and vitamins. Proteins play a double role and must necessarily be adequately provided in the ration. They are essential for growth, for repairing wear and tear of the tissues and for the production of milk and, in common with fats and carbohydrates, on oxidation in the animal system supply energy for work, keep the animal warm and when fed in excess of the requirement fatten the animal. Mineral matter is chiefly concerned in the making of the skeleton. Vitamins though required in extremely small quantities are absolutely essential and play a unique role in regulating the life processes. In their absence animals in spite of getting other nutrients in adequate quantities suffer from deficiency diseases such as poor growth, rickets, deformed bones and teeth, etc.

LAL CHAND DHARMANI is Agricultural Chemist, Punjab and KARTAR SINGH LOHARA belongs to the Department of Agriculture, Punjab.

Digestible proteins and nutrients

Foodstuffs rich in proteins are legumes, oilseeds and oilcakes, in fats oilseed and oilcakes, in carbohydrates cereals, and in vitamins green growing parts of plants. The animal utilizes only such amounts of the food constituents as it is capable of digesting from a foodstuff. The amounts digested are determined by conducting digestibility trials and for easy computation of rations, the nutritive value of a foodstuff is expressed in two terms (a) digestible protein and (b) total digestible nutrients. Total digestible nutrients are calculated by adding up the digestible protein, the digestible carbohydrate and $2\frac{1}{4}$ times the digestible fat, and, as the name implies, this term represents the value of a foodstuff for all purposes. It also forms a useful basis for purchasing concentrates as their market price does not necessarily vary according to their nutritive value on account of which it may be necessary at times to choose one foodstuff in preference to another.

The requirements both for maintenance and production of different classes of animals and the feeding values of various feeding stuffs are given in Tables I, II and III. By the help of these Tables one can easily compute balanced rations. It should be kept in mind that the ration should be made up of feeds of a suitable nature for a particular class of animals, should be palatable and should contain sufficient dry matter to satisfy the appetite of the animals. Further, it should be as cheap as possible. There should be a sufficient supply of necessary minerals and vitamins in the daily diet in order to ensure normal growth and good production. When a ration is made from a variety of foodstuffs containing sufficient green fodder, there is little chance of vitamins running short.

TABLE I

Requirements for maintenance and production

	Maintenance		For each pound of milk produced	
	Total digestible nutrients	Digestible protein	Total digestible nutrients	Digestible protein
	lb.	lb.	lb.	lb.
Cow in milk, body weight 800 lb. or 390 seers ..	6·2	0·46	0·36	0·048
Buffalo in milk, body weight 1,400 lb. or 683 seers ..	12·2	1·06	0·48	0·066
			For ploughing one acre a day and maintenance	
Working bullock, body weight 1,000 lb. or 488 seers	7·0	0·57	9·0–9·5	0·58–0·60

Note. (i) Approximate body weight can be calculated by the following formula:

$$\text{Body weight in seers} = \frac{\text{Girth in inches} \times \text{length in inches}^2}{9}$$

(ii) One pound should be taken as half a seer.

TABLE II

Feeding values of some Punjab feeds (concentrates)

Name of the feed	Total digestible nutrients per cent	Digestible protein per cent
Oilseeds		
Cotton seed (*Desi*) ..	73·0	8·0
Cotton seed 4F ..	70·6	10·5
Cotton seed 43F ..	89·0	13·7
Cotton seed 285F ..	82·9	12·5
Cotton seed 289F ..	74·2	11·6
Linseed	108·8	14·8
Sarson seed	104·8	19·8
Soy bean	76·7	34·7
Oilseed cakes		
Cotton seed cake (undecorticated) ..	72·5	18·0
Groundnut cake ..	79·1	31·1
Linseed cake ..	82·6	23·6
Sarson cake ..	81·6	25·7
Taramira cake ..	85·6	29·0
Til cake	94·0	38·3
Toria cake ..	74·4	30·5
Grains and their by-products		
Arhar	67·7	13·1
Bajra	54·3	4·9
Chari	73·7	6·4
Barley	70·8	6·7
Gram	79·6	12·4
Guara	72·8	28·8
Maize	70·5	5·4
Matri	68·7	18·4
Moth	72·3	17·4
Oats	66·9	4·5
Rawan	62·3	18·6
Rice bran	62·9	8·2
Wheat	84·0	5·8
Wheat bran ..	70·8	8·9
Wheat *mamni* ..	54·9	6·5

TABLE III

Feeding values of some Punjab feeds (roughages)

Name of the feed	Total digestible nutrients per cent	Digestible protein per cent
Straw and hays		
Berseem hay ..	50·0	9·0
Jowar hay ..	43·0	1·7
Maize hay ..	44·0	2·7
Oat hay	52·1	1·7
Anjan grass hay ..	34·6	3·0
Dub grass hay ..	36·4	5·5
Musal hay ..	29·4	0·4 N.M.
Janeva hay ..	25·9	.. do.
Rice straw ..	39·0	.. do.
Wheat *bhusa* ..	45·0	.. do.
Dry grasses from different places		
Ambala	29·4	2·3
Ferozepur ..	32·1	4·9
Dalhousie ..	29·9	0·6 N.M.
Jullundur ..	27·8	0·8 do.
Jutogh	29·1	0·6 do.
Kasauli	27·9	0·7 do.

TABLE III—(*Contd.*)

Feeding values of some Punjab feeds (roughages)

Name of the feed	Total digestible nutrients per cent	Digestible protein per cent
Green fodders		
Bajra	12·8	0·9
Barley	14·3	2·3
Berseem ..	10·0	2·2
Elephant or Napier grass	11·7	0·6
Guara	12·0	2·4
Guinea grass ..	12·2	0·8
Jowar or *chari* ..	21·2	0·8
Maize ..	15·0	1·0
Oats	10·9	1·2
Senji	13·2	2·7
Sudangrass ..	16·0	0·4
Sunflower ..	10·7	1·8
Turnip leaves ..	10·9	1·2
Sugarcane (*katha*) ..	23·7	.. N.M.
Sugarcane (tops) ..	19·3	0·4

From data given in Tables, I, II and III, it is now easy to compute rations for different types of animals and a few examples of balanced rations are given below as illustrations.

I. *Ration for a cow of 800 lb. body weight and giving 16·0 lb. of milk*

	Total digestible nutrients lb.	Digestible protein lb.
Maintenance ..	6·20	0·46
For producing 16·0 lb. of milk	5·76	0·76
Total	11·96	1·22

	Quantity of different items of ration required in lb.	lb.	lb.
Wheat *bhusa* ..	8·5	3·82	..
Berseem green	40·0	4·00	0·88
Bran	3·0	2·12	0·27
Bajra grain	3·0	2·01	0·13
Total		11·95	1·28

II. *Ration for a bullock of 1,000 lb. body weight and ploughing one acre a day with the* desi *plough.*

	Total digestible nutrients lb.	Digestible protein lb.
Requirements for work and maintenance	9·0–9·5	0·58-0·60

	Quantity of different items of ration required in lb.	lb.	lb.
Wheat *bhusa* ..	10	4·5	..
Maize green ..	16	2·4	0·16
Gram ..	2	1·6	02·5
Cottonseed cake	1	0·7	0·18
Total		9·2	0·59

III. *Ration for a buffalo of 1,400 lb. body weight and giving 20 lb. of milk*

	Total digestible nutrients lb.	Digestible protein lb.
Maintenance requirements	12·2	1·06
Requirements for 20 lb. of milk	9·6	1·32
Total	21·8	2·38

	Quantity of different items of ration required in lb.	lb.	lb.
Wheat *bhusa* ..	20	9·00	..
Berseem green	62	6·20	1·36
Gram ..	2	1·60	0·25
Toria Cake	1	0·74	0·30
Bran ..	1	0·70	0·09
Cotton seed 43F	4	3·56	0·55
Total		21·80	2·55

One must not look upon these standards as a hard and fast rule to be followed at all times but only as a guide with reference to the particular feeds available and the kind of animals to be fed.

Dry matter per cent in dry roughages and concentrates should be taken 90 per cent and in green fodders 20 to 25 per cent according to the stage of the fodders at which it is cut; berseem at 12 per cent.

Rajiv Gopalan

HEAT STROKE IN POULTRY

By HARJAS RAI and S. P. BERI

THE effects of hot weather on man and large animals are universally known in this country; but the significance of this weather is not often realized in poultry except by a few educated poultry keepers. Most of the books on the diseases of poultry have also not given to it the importance it deserves. In fact, the adverse effects of hot weather is fairly common, affecting practically all domestic poultry and is responsible for considerable losses in birds of all ages, especially in mature and rather fat fowls. Even at a place like Ajmer where extremes of high temperature are not experienced during summer as in some other parts of India, several reports of birds dying of heat stroke are received. Some birds of the Government Poultry Farm, Ajmer, died on account of this.

When fowls are immunized against Ranikhet disease, the post-vaccination losses in severe hot weather may reach 10 per cent due to metabolic disturbances caused by heat. After proper investigations, it is now generally believed that the incidence of fowl cholera, which sometimes resembles heat stroke in India in symptoms, is somewhat rare. Heat stroke is different from sun stroke in the sense that the former is not directly caused by sun rays, but is due to an excessively high temperature resulting in abnormally high production of heat. The distinction is not important from clinical point of view. The incidence of heat stroke has been noted more in imported breeds, specially in heavy breeds which are of large size and have super-abundance of feathers.

Cause

Sun stroke frequently results from direct exposure to the rays of the sun during summer, especially when there is severe heat wave and adequate shade is lacking in the pens. This may occur when the birds are carried from one place to another in uncovered cages which are exposed to sun. Apart from sunlight, high external temperatures may result when the poultry is kept overcrowded in pens and railway wagons or are over-exerted by long chase. Some times two or more birds enter in the trap-nest for laying and the birds are not released soon. The high atmospheric temperatures in summer, and the body heat of the birds in the small enclosed place in the trap-nest, give rise to a similar condition. Hence, the direct rays of sun are not essential for producing this condition as it may occur during the night time also. Experience has shown that Rhodes are very sensitive regarding balanced rations and they very easily put on fat when fed on starchy feeds like maize. The fat obviously makes them more susceptible to high temperature. Acclimatization and individual susceptibility are also important contributing factors. In spite of wide fluctuations in the rate of heat production and heat loss, the body temperature in animals varies within narrow limits. One of the means for maintaining this constancy is physical regulation under which the resultant rise in body temperature, when heat production exceeds heat loss, is accompanied by an increased secretion of sweat. Absence of sweat glands in poultry, and their inability to ward off heat because of the feathers, is another factor why poultry are more susceptible. Humid atmosphere is generally associated with more cases of heat stroke as the heat loss is impeded by moist atmospheric conditions.

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Symptoms

The attack usually occurs with dramatic suddenness, a bird being found dead which was perfectly normal some time back. Not infrequently well-marked symptoms are also observed which start with shallow and frequent respiration through the open beak. With each respiration, the windpipe rises and falls visibly. The bird is weary and dull with an unsteady staggering gait. The body temperature rises very high;

but with brain affection, it may fall. The wings droop and the bird looks much depressed with rapidly progressive debility. Later the bird is distressed and badly collapses from weakness usually within two to three hours. There is often rupture of ovary ; liver rupture and internal bleeding is also not uncommon. In young stock the rate of growth is seriously retarded by high temperatures.

Diagnosis

The exact diagnosis can be arrived at by eliminating various poultry diseases. However, in summer, when birds begin to die suddenly and show in some cases symptoms similar to those described above, one can reasonably suspect the cause of death to be heat stroke. The common changes found are abnormal congestion of internal organs especially of the heart. The brain is highly congested and also presents small haemorrhages.

Discussion

The effect is thought to be produced as a result of the action of extreme heat on the brain. Direct sun rays on the bird might dilate the blood vessels of the brain with consequent inflow of more of blood, thus causing appearance of the symptoms. Some research workers are of opinion that nerve cell of the brain are damaged by the chemically active, ultra violet rays of the sun. More convincing is the hypothesis that the sun rays cause overheating of the brain and causes paralysis of the centres in the brain which control locomotion and respiration. This increased heat of the body, assisted by the ultimate failure of the apparatus regulating body temperature, produces the paralytic effects of heat (heat stroke). In short, heat or sunstroke represents a manifestation of accumulated body heat. A scientific study of the subject has been made with Australorps in Australia by some workers and their conclusions are as follows :

(i) Death is likely to occur when shade temperatures exceed 105°F. and the exposure is for more than one hour.

(ii) Hens are less likely to die if given an opportunity to become acclimatized.

(iii) At 113°F. (rectal temperature) true heat stroke is noted and death follows unless prompt treatment is given.

(iv) When the rectal temperature reaches 108°F. the hen will start panting.

(v) When panting the evaporation of water from the hen rises to one ounce per hour.

Treatment

Remove the affected bird to a cool place as quickly as possible and give it a cold bath. It should be kept in a cool place for several hours. Cold water should be given for drinking and an enema may also be administered. In the case of heat exhaustion stimulants are indicated. When the acute attack is passed, about 10 to 15 grains (according to the size of the bird) of epsom salt may be given in half an ounce of water. Potassium iodide (one to two grains) in water given orally has also been found quite useful. Treatment is not successful in all cases. Hence, more efforts should be directed towards prevention. Poultry houses may be given protection from sun by erecting thatched roofs (*chupper*).

Prevention

Always provide more shade in the pen and plenty of cold water to drink. Mulberry trees in the runs are excellent for providing shade during hot weather. Mashes should be given more wet than usual. The trapnests should be well-ventilated and kept in shade. These should not be kept adjacent to a wall which is exposed to the sun to avoid heat radiation. Dig nine inches deep angular pits in the runs in shady places, the pits varying according to the number of birds, in which waters should be poured twice daily during the hot hours of the day. These provide great comfort to the birds which sit in these, and save them from hot winds. They really enjoy this wet mud bath. On extremely hot days it is advisable to sprinkle some water even on the birds themselves. Metal utensils for watering should preferably be avoided and earthen vessels substituted in their place. Feed control is an important factor in preventing heat stroke cases. With the advent of summer one should start feeding more of bulky stuffs like greens and mash, cutting down feeds like maize which help in putting on fat.

What the Scientists are doing

TRIAL OF RUSSIAN RICE IN INDIA

A REUTER message, dated 2 June, 1946, from London announced a new kind of paddy claimed to have been developed in the USSR. It was said to grow on dry steppes, ripen a month ahead of ordinary varieties and need no water before harvesting.

The I.C.A.R. obtained six kilograms of seeds of this new variety 'Kraanodar' in April 1947 and distributed to various centres for trial. The results of the performance are summarized below :

1. *Madras :* The variety was grown at nine different Agricultural Stations (Pattambi, Mangalore, Anakapalli, Samalkota, Marutaru, Siruguppa, Nandyal, Hagari and Tirrurkuppam), under rain-fed conditions in the province between the months of May and August 1948.

Germination was poor in most cases and the few plants that emerged were deficient in vigour and tillering. The yield was extremely low in consequence. It was concluded by the Provincial Department of Agriculture, from these results, that the Russian variety had not been found suitable in any season in any part of the province ; and this was attributed to the relatively shorter day-length of South India.

2. *Uttar Pradesh :* During the 1948 season the Russian variety was included in a preliminary varietal trial with T_{21} as standard. Though, the Russian variety was 12 days earlier, its yield was significantly lower than that of T_{21}, being only 47 per cent of the standard. Further, the variety did not appear to be any more drought-resistant than their early varieties. The Department of Agriculture is, therefore, of the opinion that the Russian variety will not be of any use to them except as a possible parent capable of transmitting early maturity character in hybridization work. The collections of exotic rices of the Provincial Department include even earlier varieties such as Chinese, Californian and Italian.

3. *West Bengal :* Trials were conducted at Dacca prior to the partition but their results are not available.

4. *Indian Agricultural Research Institute :* At the Botanical Sub-station, Pusa, the variety was found to ripen three to four weeks earlier than any of the other varieties in the collection and also require less water. But it was not as good as the local varieties either in yield or quality of the grain.

5. *Central Rice Research Institute, Cuttack :* When sown in June 1947, it matured in 61 days, growth was stunted, tillering and yield were both very poor. During 1948 sown on high land as a line-sown crop, it matured in 65 days but on low land as a transplanted crop, it took another ten days to mature. The growth, tillering and yield were all poor as in the previous season. The variety has a short, coarse, white grain. The Director is of the opinion that while there is no scope for its being grown as a field crop the early maturity is an advantage which can be utilized in hybridization work. (R.S.).

You ask We answer

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in States. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

MALEKIZATION OF RICE

Q. What is Malekization of Rice ?

A. One of the important contributions to the development of food products in the United States during World War II has been a new process known as 'Malek Rice Process'. Malekizing, the modern parboiling method, is reported to confer a great advantage on the rice miller as well as the consumer. It consists of four major stages, namely cleaning, soaking, steaming and drying. The sound grains are given a controlled soaking and then passed on to a specially developed continuous pressure cooker. In the soaking and steaming the vitamins of the bran and the 'germ' are diffused throughout the kernel and the rice starch changes to a stable hardened form ; the drier and cooler remove excess moisture, leaving hard processed rice ready for normal storage and subsequent milling.

The advantages claimed by the 'Malek' process are as follows :

(i) Coarse and chalky grains of rice become fine and translucent.

(ii) While the total mill yield is as high as 81 per cent it is only 62 per cent in the case of ordinary rice.

(iii) Weevil infestation is completely eliminated.

(iv) Malekized milled rice retains 55 per cent of thiamin, 75 per cent of niacin and 72·5 per cent of riboflavin present in paddy. The corresponding values for the ordinary milled rice are only 17, 38·5 and 40 per cent respectively.

(v) Malekizing produces a partial dextrinization of starch which is desirable as dextrinized starch is more readily assimilated in the human body.

(vi) Cooking qualities of malekized rice are superior to those of the very best types of ordinary parboiled rice. Malekized rice swells in cooking from 5 to 20 per cent more than the same type of ordinary rice. (R.S.)

PUNJAB

DILBAGH SINGH

THE State comprises of 13 districts. There are at present 195 veterinary hospitals and 29 outlying dispensaries in the province. During the quarter under report 336,742 cases were treated and 43,941 castrations were performed in these institutions.

Contagious diseases

During the period under report, 712 reports of contagious diseases were received. Of these 410 were of haemorrhagic septicaemia, 291 of foot-and-mouth disease, two of black-quarter, one of anthrax and eight of rinderpest. Outbreaks of rinderpest have been few on account of largescale immunization undertaken against this disease.

Vaccination and inoculation

Altogether 215,844 goat virus vaccinations, 5,372 anti-rinderpest inoculations against cattle plague, 181,683 vaccinations and 24,269 inoculations against haemorrhagic septicaemia were carried out during the quarter under report.

Goatish production

In the Veterinary Vaccine Institute, Dagshai 335,400 doses of goat tissue virus vaccine were produced. These were supplied to field staff serving in Punjab, Delhi and Himachal Pradesh.

Livestock breeding

There were 8,961 cows and buffalo bulls at stud on 30 September, 1949 in the province. More bulls will be supplied from the Livestock Farm, Hissar according to the financial position of the District Boards. A total of 117 animals of different species such as bulls, cows, donkeys, rams and goats was issued for breeding purposes from the Farm above. Rs. 52,037-8 were realized as price of these pedigree animals.

DILBAGH SINGH, L.V.P., P.V.S., is Personal Assistant to the Director, Veterinary Services, Punjab, Dagshai.

Cattle fairs

Sixty-two cattle fairs were held at various places in the province. The highest and lowest prices at which the animals were sold are given below :

Bahu Jholary cattle fair : 3,360 animals entered the fair ground, out of which 671 were sold.

	Bullock	Buffalo	Camel
	Rs.	Rs.	Rs.
Highest price ..	850	320	752
Lowest price ..	100	62	155

Cattle fair, Nahar : 2,124 animals entered the fair ground, out of which 401 animals were sold.

	Bullock	Buffalo	Camel
	Rs.	Rs.	Rs.
Highest price ..	630	300	450
Lowest price ..	62	25	300

Cattle fair, Gohana : 18,028 animals entered the fair ground out of which 1,818 animals were sold.

	Bullock	Buffalo	Camel
	Rs.	Rs.	Rs.
Highest price ..	900	550	..
Lowest price ..	62	20	..

Fortnightly prevailing price of cattle

The average market price according to the breed is given below :

Kind of livestock	Name of breed	Average prices
Bullock	Hariana	Rs. 500 to Rs. 600
	Nagori	Rs. 600
Buffaloes	Murrah	Rs. 400 to Rs. 800

Gowshalas

Sixty-one *gowshalas* were visited by the staff and officers of the department during the quarter under report. Two *Gowshala* Development Boards, one for each Revenue division of the province, have been organized by the Government. With the help of Divisional Superintendents and Dairy Development Officer these Boards will find out ways and means to improve these institutions.

Dairy development work

In the Dairy farm section attached to Government Livestock Farm, Hissar, 233,597 lb. of cow and buffalo milk was produced during the quarter under report. Rs. 41,761-1 were realized from the sale of the milk. The dairy development staff visited 122 villages, 36 *gowshalas* and 352 milk *addas* and dairies. Two hundred and ninety-two lectures were delivered by the dairy staff on various aspects of dairying. A three months' course in dairying has been started at the Government Livestock Farm, Hissar.

Fisheries

During the period under report 1,363 licences for fishing were issued. Rs. 5,831-2 were realized as licensing fee. One hundred and sixty-five cases of illegal fishing were compounded and Rs. 1,110 realized as fine. About 212 maunds of fish were caught and Rs. 2,101-12-3 credited into the treasury as its sale proceeds.

The following livestock is found in the Mahili Trout Farm (Katrain), District Kangra :

Brown trout breeders	..	96
Brown trout of 1946	..	121
Brown trout of 1947	..	53
Brown trout of 1949	..	688

A scheme for stocking with fish a large number of impounded waters has been sanctioned by the Government. Staff is being recruited under this scheme.

Poultry husbandry

A total of 2,079 eggs was produced at the Poultry farms during the quarter under report. Four hundred thirty-nine birds have been supplied to public for breeding. Rs. 1,972-2-6 were realized from the sale of these eggs and birds. Ex-servicemen are being trained in poultry husbandry in batches at the Government Poultry Farm, Gurdaspur.

CATTLE SHOV

M. K.

THE role of propaganda in making a department popular and effective cannot be underrated. Holding of exhibitions has been found to be useful in more than one way. Thus, to popularize its activities, the Animal Husbandry and Veterinary Department in Orissa used to organize cattle shows, which, unfortunately in the past, used to be quite limited in number. But, last year a good number of shows were organized and in which other departments also participated. The main objects for holding these cattle shows have been: (i) Improvement of livestock, (ii) providing an impetus to the public at large for adopting the imparted knowledge for enriching cattle wealth, (iii) to afford an opportunity for a large number of cultivators to get in touch with one another for exchange of ideas on the matters of livestock, and (iv) to get recent information on the various aspects of the animal husbandry and veterinary science.

Last year as many as 84 village, 7 district, 3 regional and 1 provincial shows were held. The Orissa Government allotted a generous amount for this purpose. Rs. 200 were spent on each village show, Rs. 500 on each district show, Rs. 2,500 on a regional show and Rs. 9,000 on the provincial show. Besides these amounts, Agriculture Department also contributed some amount.

Village shows

Altogether 38 shows were held in the old districts and 46 in the integrated areas. These shows, as the name implies, are held in rural areas. As these shows were an innovation for the villagers, they attended these in large numbers, and evinced keen interest in livestock and their judging. Cash prizes and certificates were given to owners of best livestock in the show and also for best Agricultural products.

M. K. PATRA is Goshala Development Officer Orissa, Cuttack.

VS IN ORISSA

PATRA

Dharamshala show: The show was held under the presidentship of the Sub-divisional Officer, Jajpur. Stalls were beautifully decorated by officers of various departments. Altogether 124 livestock were exhibited and a sum of Rs. 140 was awarded to prize-winners. The officers present addressed the gathering about the utility of cattle shows in the province. There were also other entertainments throughout the day. People in thousands from the neighbouring villages came to see the show.

District shows

Out of the seven shows, some were held at district headquarters and others at sub-divisional headquarters. These are bigger than the village shows.

Balasore show: The show was held for two days in the Permit Field in the centre of the town and was opened by the District Magistrate, Balasore. Prizes were awarded by the Additional District Magistrate. A number of distinguished visitors were present. Lectures were delivered by different departmental officers. Magic lantern demonstration was also given. Animals and birds totalling 313 were exhibited in the show. Cash prizes, medals and certificates were awarded.

Regional shows

These shows have been introduced for the first time in this province on the model of the All-India Regional Cattle Shows. Thus, one show each at Angul, Balangir and Jeypore was held.

Angul show: The show was held for three days. The show ground besides the sheds for livestock of different classes had 65 stalls for accommodating the exhibits brought by the various departments and private persons of the district including the newly integrated States. The ground was decorated with *shamiana* and festoons. The *pandal* had an attractive gate. The following departments

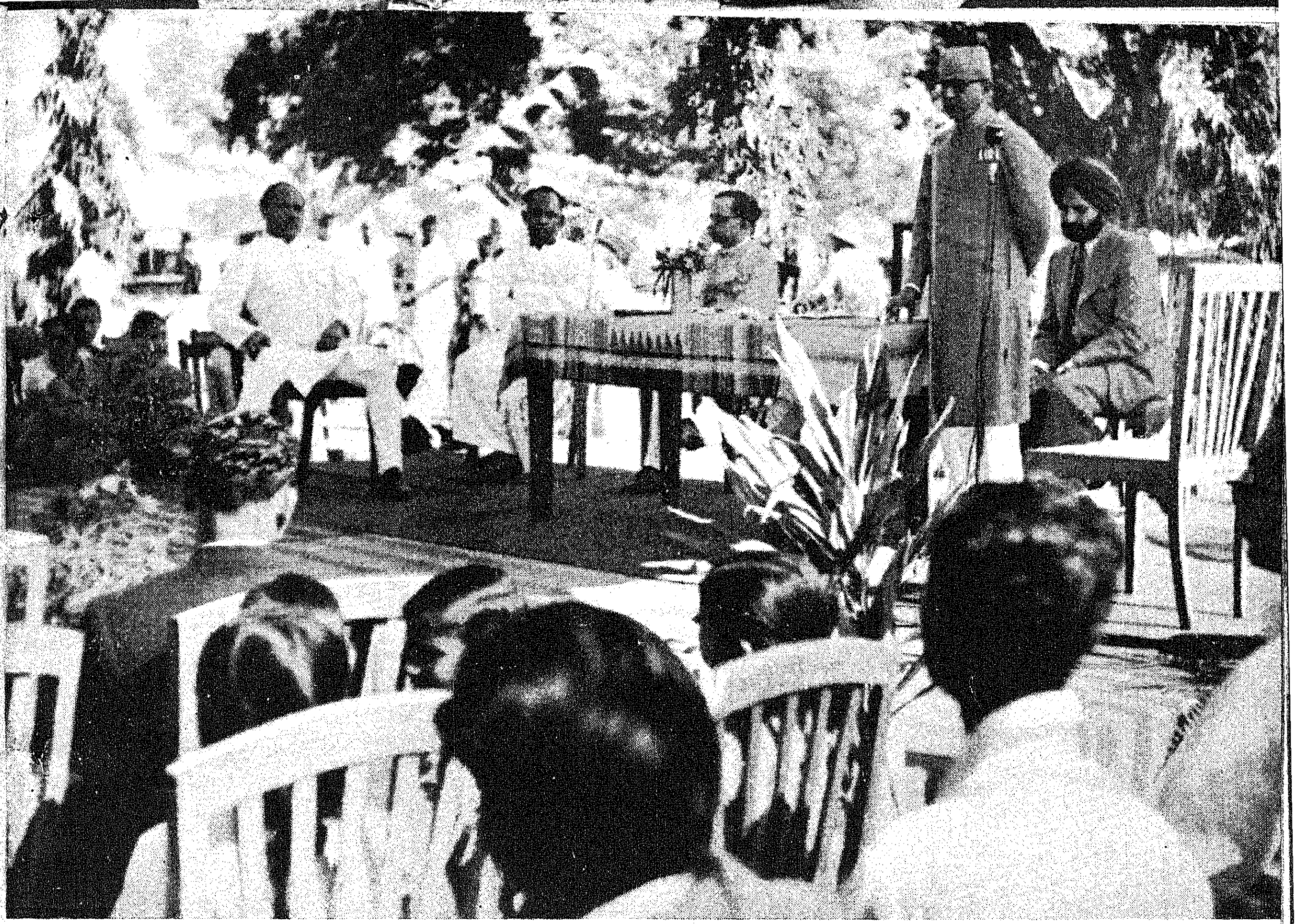


FIG. 1. His Excellency Shri Asaf Ali, the Governor of Orissa, addressing the gathering before the opening of the Fifth Provincial Cattle Show.

FIG. 2. Poultry Section.

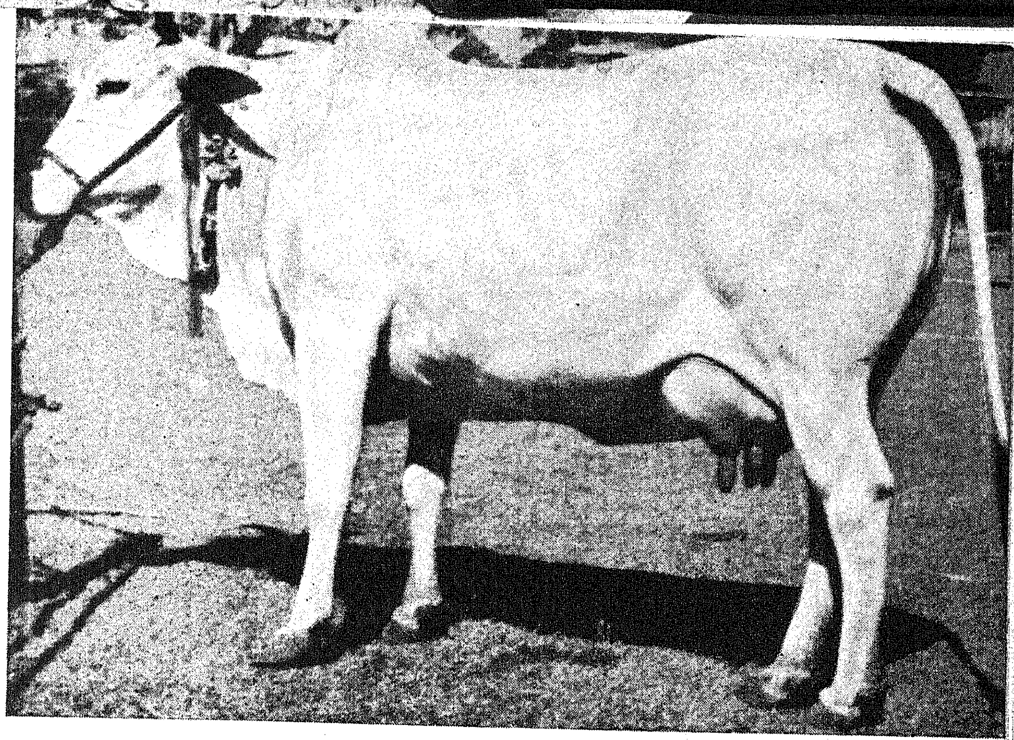
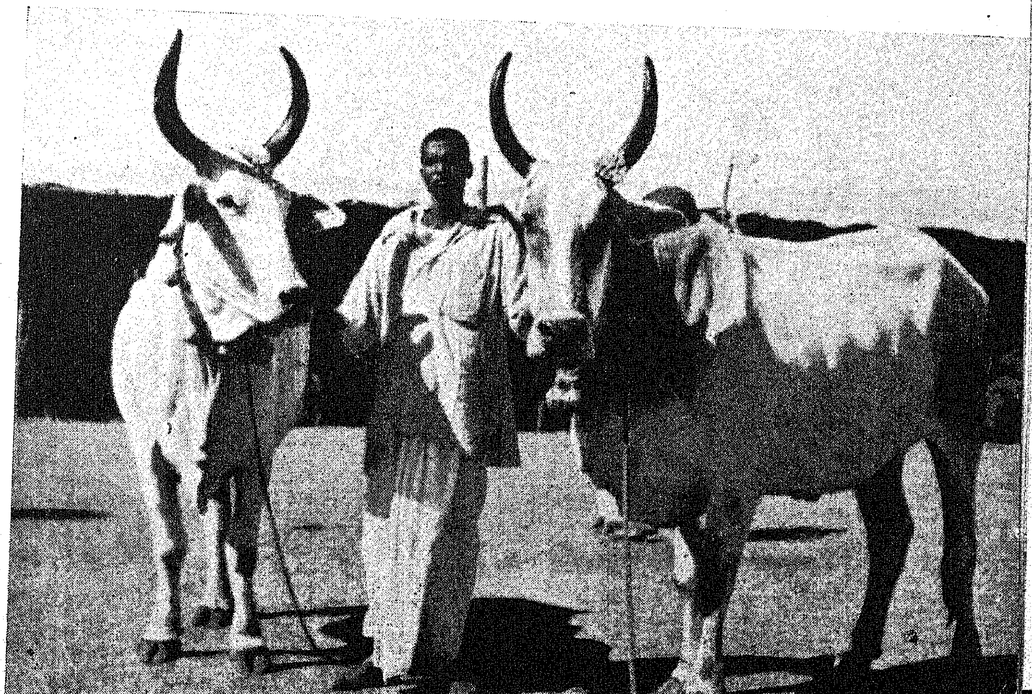


FIG. 3. Champion cow.

FIG. 4. A pair of *deshi* bullocks.



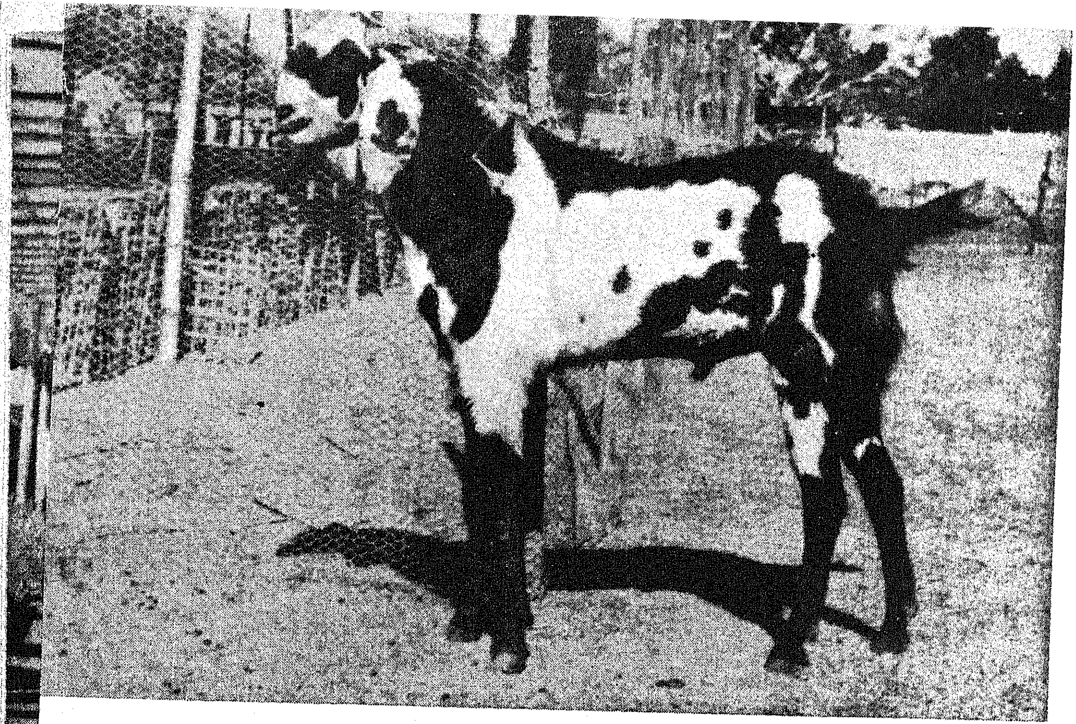
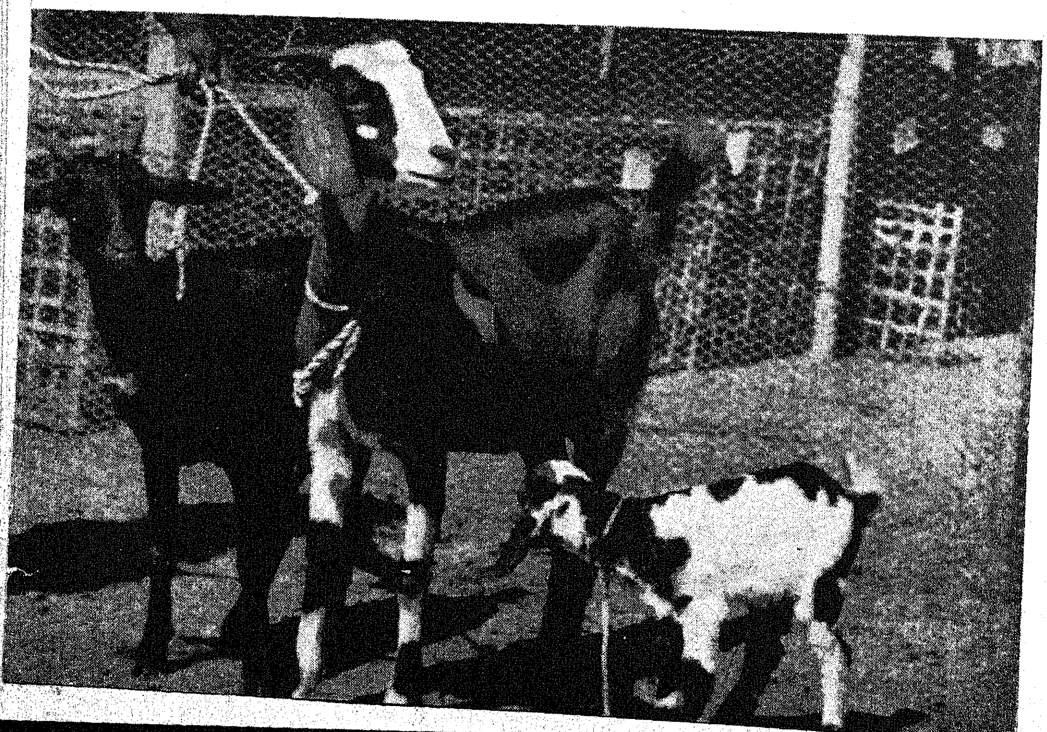


FIG. 5. Beetal buck.

FIG. 6. Graded Beetal from black Bengal doe.



took part in the show: (1) 'Grow more food' with Horticulture section. (2) Village Welfare. (3) Publicity. (4) Education. (5) Fishery. (6) Public Works Department. (7) Cooperative. (8) Juvenile Jail. Besides these the High School, Basic Training School, Industrial School and Girls' School exhibited some beautiful articles. The opening ceremony was performed by hon. Lala Ranjit Singh Bariah and was attended by distinguished persons of the town. After a brief speech he visited all the stalls and the Livestock Section. The hon. Minister while visiting the stalls evinced great pleasure in the success of the show. Villagers from the surrounding area came in large numbers to visit the show and on the last day the crowd was about 10,000 or more. Magic lantern show regarding cattle diseases was shown by the Animal Husbandry and Veterinary Department. Besides country music, *palla*, *paika* dance, *daskathia* were arranged which added to the success of the show.

There were altogether 511 livestock exhibits including Hariana, graded Hariana, indigenous cattle, Murrah, graded Murrah, *desi* milch and draught buffaloes, Sindhi, Bikaneri, graded Bikaneri, *desi* sheep, Beetal, graded Beetal, South Orissa goats, White Leghorn, R.I.R., cross breds and R.I.R. graded, geese, ducks, indigenous horses, and pigs. The livestock were fed at the cost of the show committee.

Cash payments of attractive amounts were distributed to private winners, certificates to the winners of Government Institutions and a Challenge Cup donated by the Chief Administrator for the best animal of the show was won by the cow of Boudh Dairy Farm.

Balangir show: This was the second regional show and was the first of its kind in this region.

The show was opened by Sri Judhistir Misra, member of the Constituent Assembly. He exhorted the people to improve their livestock industries. One hundred and fifty cattle of different breeds such as Sindhi, Hariana, Murrah and indigenous cattle were exhibited. About 40 sheeps and goats including Bikaneri, Beetal, graded Beetal and *desi* were also among the livestock exhibits. There were also good number of entries in the Poultry Section. Magic lantern show and country dances were also shown. Cash prizes amounting to Rs. 754 and certificates to the owners of best livestock were awarded.

Jeypore show: The third regional show was held in the agency tract for three days. The Maharaja Saheb of Jeypore opened the show. This was attended largely by tribal people. Four hundred and thirty-nine livestock and birds were exhibited. The speciality in the livestock section is the entry of a special type of local cattle called 'Mother Cattle'. These animals are red and are seen in large numbers in the Malkangiri taluk of Koraput district. These are kept in a semi-ranch system by the aborigines. One hundred and twenty prizes were awarded in cash as well as certificates.

Provincial cattle show

The Fifth Orissa Provincial Cattle Show was held at Cuttack from 12 January, 1949 to 16 January, 1949. The show was opened by His Excellency Mr. Asaf Ali, Bar-at-Law, the Governor of Orissa in the presence of a large distinguished gathering. His Excellency in the course of his address said, 'The building up of the cattle wealth of the country and specially of Orissa is one of our primary duties. For on it depends the entire structure of agriculture and dairy products. We have in our province more than one crore of cattle and bovine species and it is a regrettable fact that the total availability of milk does not cover $\frac{1}{2}$ oz. per head per day. Our people do not pay much attention to the welfare of our cattle which has direct connection with their lives in spite of their strong faith that cows are worthy of worship'.

His Excellency further remarked that our livestock are a poor comparison with cattle of the Western countries and that we do not derive as much benefit from our cattle wealth as do other countries because we do not pay scientific attention to it.

The Animal Husbandry and Veterinary Department set up stalls to demonstrate scientific methods of breeding, feeding, management and control of disease and pests of livestock, dairying, poultry, wool, hides and skins and demonstration of different kinds of fodder cultivation, silo

pits and manure pits, etc.

Stalls were also set up by the agricultural, industries, fishery, textile cooperative, jail, Mayurbhanj village welfare, welfare for backward class, cottage industry departments.

The total livestock exhibited was 707 as compared to 617 of last year.

PROGRESS IN RICE RESEARCH

YIELD trials of rice varieties undertaken at the Central Rice Research Institute, Cuttack, have indicated the possibility of introducing two crops of paddy in certain parts of Orissa where at present only one grows. This is revealed in the first report of the Institute, just published, covering the period from September 1946 to June 1948.

The Institute has collected over 2,000 species of rice varieties, both of India and abroad with a view to (a) finding out the most prolific strains amongst the early varieties ; (b) standardization of the types for cultivation over large areas in the country and (c) for study of the genetics of the crop and exploiting the material for production purposes. A large number of varieties collected have been studied and the performances of some of the promising ones were tested in a number of yield trials. One interesting result arising from these trials has been the great possibility of stepping up of rice production in parts of Orissa, particularly in the canal irrigated areas where it has been found that two crops can be grown in succession. Further investigations are proceeding about the most suitable varieties to be grown as the first and the second crop. (*P.I.B.*)

VETERINARY ASPECTS OF ATOMIC EXPLOSION*

By WAYNE O. KESTER and EVERETT B. MILLER

THIS is not a technical paper on atomic explosion but rather an attempt to express in simple terms, the conditions that a veterinarian might see, were he called to an area where an atomic bomb had recently exploded. Some of the unsolved problems confronting the veterinary profession are mentioned, and such meagre facts as are known about atomic explosion with respect to veterinary medicine are set forth. It is hoped that the reader may rationally grasp the significance of atomic explosion to veterinary medicine and realize that atomic warfare, destructive as it is, is a thing for which we can and must be prepared.

No two of the five atomic bomb detonations which the world has thus far seen have been exactly alike. The type of burst has varied from several hundred feet above the surface of the earth to several feet under water, and two types of bombs, uranium 235 and plutonium have been employed. As might be expected, certain aspects of the results varied materially in each instance. However, from the standpoint of veterinary medicine, these variations seem to make little difference in end results. Nor does it appear that the development of larger or new type bombs or changes in the methods of employment would greatly affect the picture in so far as the veterinarian is concerned. He will still be faced with the same entities and problems, the variables being chiefly those of quantity and degree.

Types of injuries

Although large numbers of animals have not been exposed to atomic explosion, there is no reason to believe that the effects will vary greatly from those seen in man. Casualties will be due to blast, burn, or radiation, but more probably a combination of all three. Blast and burn injuries, both physical in nature, will be little different than when produced by other conventional explosive type weapons or other means, except that they will be of greater magnitude in number, extent, and degree than seen elsewhere.

Primary shock or blast damage, defined as the compressive and tearing action of the shock wave on the living body, is seldom seen. Secondary shock or blast damage is the more important and is caused by the living body being blown against an object or by the millions of pieces of flying timber, glass, rock, and other debris driven by the terrific explosive force of the bomb burst, estimated to be greater than that of 20,000 tons of T.N.T.

Flash burn injuries will result from the direct effect of the heat flash radiated simultaneously with the explosion, a radiant energy estimated to be, for an instance, many times greater than that of the sun. If buildings or other combustible materials are present in the area, flame burn injuries due to the numerous fires started by the explosion and flash will be a serious problem also.

The third type of injury, ionization of tissues caused by nuclear radiation, is the new entity in the picture. An individual may absorb radiation from external sources,

*Acknowledgment for the basic precepts of atomic warfare in veterinary medicine is given to the several lecturers and recognized authorities who appeared at the Medical Indoctrination Courses in the Medical Aspects of Atomic Explosion, sponsored by the Armed Forces Special Weapons Project, that were given recently at the Army Medical Department Research and Graduate School, Army Medical Centre, Washington, D. C.

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i.e. when the source of the radiation is outside of the body the rays penetrate the skin and deeper tissues, or he may absorb it from internal sources as is the case when the source of the radiation (radioactive material) is taken into the body by ingestion, inhalation, or through a break in the skin, and remains as a constant source of ionizing rays until eliminated or neutralized by normal radioactive decay. This latter is most serious because once radioactive substances have been taken up by the body there is no means of effecting removal.

Chief sources of radiation damage are the gamma rays, alpha particles, beta particles, neutrons, and other fission products released by the bomb detonation. It is estimated that approximately 99 per cent of the total radiation damage occurs simultaneously with the explosion which, in effect, might be likened to the instantaneous exposure to tons of radium or a gigantic x-ray machine emitting lethal rays. This is known as prompt, or immediate radiation.

The balance of the radiation (delayed radiation) damage occurs subsequent to the detonation of the bomb and is caused by residual contamination. There are two ways in which residual contamination may occur. One is by objects in the vicinity of the bomb burst 'capturing' neutrons and thereby acquiring radioactive properties and the ability to emit lethal rays. The other way is by fission products and other radioactive material, almost all of which exist on particles of dust or droplets of water, settling out of the atomic bomb cloud. These particles, which continue to emit lethal rays, may settle to the ground near the bomb explosion or may drift many miles with the cloud before settling or dissipating.

Radiation sickness

The amount and duration of this residual contamination varies with the type of bomb, altitude of the burst, and rate of radioactive decay of the elements activated. Where the explosion is close to the ground, residual contamination may be present for some time. In Japan, where the detonations were at fairly high altitude, there was very little detectable radioactivity after a few days. In New Mexico, radioactive particles settling out of the bomb burst cloud, after it had drifted some 50 miles from the explosion, affected a herd of Hereford cattle mildly, resulting in their hair turning white.

Thus, it is apparent that unlike the causes for blast and burn injury, the cause for radiation sickness does not end with the dissipation of the bomb blast. It is also obvious that lethal exposure from external as well as internal radiation can occur in a contaminated area for some time subsequent to the explosion.

With bombs such as the two used in Japan, blast injuries may be expected in animals as far as five miles away from the centre of the explosion, and flash burn injuries may be expected as far as 2½ miles, except in animals which happen to be shielded from the detonation by some very substantial object. Exposure to the mass radiation generated simultaneously with the explosion will prove to be lethal for a distance of approximately one mile.

A means of differentiating animals lethally exposed to radiations from those sub-lethally exposed remains an unsolved problem. Consequently, the customary practice of promptly destroying sick and injured animals which are beyond repair, and treating only those which may recover, becomes most complicated, especially if large numbers are involved and only a limited number can be treated. Evidences of radiation sickness, unlike those of burn and blast injuries, will be little noticed initially. Symptoms will become increasingly more evident for several days, and the peak death rate caused by radiation sickness will be reached during the second or third week following the blast. Extensive observations of the symptoms of radiation sickness in man were possible following the mass exposures in Japan. Comparable observations in masses of animals have not been possible. Such studies as have been made indicate that the symptoms, especially in the smaller animals, are quite similar to those in man.

Clinical symptoms include vomiting, inappetance, diarrhoea commencing several days after exposure and later becoming bloody, irritability, skin changes, loss of hair, purpura, and progressive weakness. Within twenty-four to seventy-two hours

following a heavy exposure, a marked decrease in the total lymphocyte count is evident. Other marked changes occur in the blood picture but seem to be less constant, and their full significance has not yet been determined. On autopsy, potechial and ecchymotic haemorrhages, and hematomas are observed in all parts of the body. Anæmia, secondary infections, or toxemia due to auto-intoxication from dying tissues act individually or in combination to cause death. Those which die within a few days following mass exposure may show no pathognomonic changes on autopsy. Those living from two to six weeks will exhibit most of the above symptoms.

The appearance of the devastating physical damage wrought in the bomb blast area has been well-described in the public press. All visible blast and fire damage is due to the explosive force and flame flash of the detonation or to secondary fires. In cities, secondary fires may be expected to reach holocaust proportions. That which does not meet the eye—radioactive contamination of the area—is the third type of damage. It is a new entity in veterinary medicine. It is a decisive factor in determining the speed and effectiveness with which relief and salvage operations may be conducted.

Types of nuclear radiation

There are different types of nuclear radiation, each with different properties, but all effecting the same end result in the living body, i.e. the destructive ionization in protoplasm. Gamma rays which produce most of the damage simultaneously with the explosion have properties quite similar to x-rays but have far more power of penetration. Neutrons, also emitted with the explosion, have great penetrating power and have the added ability to induce radio activity in certain elements which they enter. This occurs near the point of detonation only and results in an added source for gamma radiation. Beta particles are also emitted by the bomb burst and by the decaying fission products released by the burst. Beta particles have practically no penetrating power and are of little danger externally ; however, beta emitting materials provide a serious hazard if absorbed internally. The alpha particle has even less penetrating power than the beta particle, but constitutes a greater hazard if it gains entrance to the body through ingestion, inhalation, or wounds.

It is evident that those supervising activities in a contaminated area must fully understand the source and significance of each type of radiation, and be able to determine the types and amounts of each present. While the detection of radiation contamination is impossible without the use of special instruments designed for the purpose, it is a simple matter when they are used. There are several types of these devices, varying in size from that of a fountain pen to that of a large camera case. Though there is no relationship, they might, in operation, be likened to the use of the common light meter employed by photographers, and are no more difficult to understand or interpret. The more useful of these monitoring devices are the Lauritsen electroscope, the pocket dosimeter, the Geiger-Muller counters, photographic film and ionization chambers. By proper use of these and other devices, it is possible to determine the type or types and amount of radioactivity present and to determine how much an individual is being exposed. All such detection meters are being improved and will be the key tools in disaster relief and salvage operations in determining where and how long personnel and animals may work in a contaminated area.

Decontamination is an unsolved problem. Unlike the situation with poisonous gases, there are no known neutralizing agents. The only alternative is to allow contaminated areas or objects to go through normal radioactive 'decay'. It may be feasible, in some instances, to speed up decontamination of an area or object by washing away, carrying away, or burying the active material.

A term frequently heard in connection with radioactive decay is the 'half life', which is merely a means or expressing rate of decay. If an object is said to have a half life of twenty-four hours, it means that the rate of decay is such that the radioactive properties of the object will be reduced by one-half during any 24-hour period, i.e. after twenty-four hours only half of the radioactive properties would remain, in forty-eight hours only one-fourth would remain, in

seventy-two hours only one-eighth, and so on. A half-life may be anywhere from a few seconds to many years, depending upon the physical properties of the object. For example, indium decays rapidly, having a half-life of seventy-two second, radioactive iodine of eight days, while plutonium decays slowly, having a half-life of 24,300 years.

Relief and salvage operations

It is apparent that there is a safe and logical approach for relief and salvage operations in a bombed area. To prevent relief parties and a curious populace, as well as inhabitants of the bombed area, from moving contaminated materials into uncontaminated areas, thereby spreading the hazard, and to prevent such personnel from unwittingly becoming overexposed to radiation, it is obvious that any bombed area must be quarantined. It would be necessary for some authoritative governmental agency, organized and equipped to administer relief on large scale, to take charge, establish the quarantine area, and enforce the quarantine.

The amount of radiation which man can tolerate without ill effects is sufficiently well-known to allow rescue and salvage parties to work in contaminated areas in complete safety if they take proper precautions. Using the special radioactivity detecting devices at hand, it will not be difficult to determine when the tolerance dose has been reached and to stay within known limits of safety from exposure. The greater the degree of contamination, the faster the exposure and the shorter the period of safety will be in the area. There are no practical protective devices or protective clothing which relief workers may use. Clothing provides some mechanical shielding but readily becomes contaminated and must be discarded. The same is true of gas masks which also afford a degree of protection by filtering out radioactive material.

Veterinary public health problems

While the foregoing answers many general questions, it does not offer a solution to the many very real and very perplexing problems in veterinary medicine which one may readily visualize. Probably the biggest and certainly some of the most pressing of these problems will lie in the veterinary public health field in instances where large stores of food or large numbers of animals have been subjected to direct or massive delayed radiation as might be the case were an atomic bomb to explode near any of our large meat packing or food processing centres. These possibilities give rise to a maze of questions as to means and methods of protecting, decontaminating, and salvaging food supplies and food-producing animals. A partial answer to many of these speculative questions may be found piecemeal in existing reports, but there is no overall analysis, pattern, or procedure to guide the veterinarian.

There are many other problems purely within the realm of veterinary medicine, such as what to do with animals, hay, grain, pasture lands, buildings, and equipment which have been exposed to radiation contamination. The veterinarian will be called upon to assess the hazard and advise the stockowner as to what course to pursue with respect to grazing on contaminated pastures, feeding contaminated hay and grain, and using contaminated facilities and equipment. He will also be called upon to diagnose, prognose, and treat animals which have received varying degrees of exposure, and he will be expected to make sound recommendations as to the most humane, practical, and economical means of disposing of such animals. In addition, he will be expected to assess the biologic effect of such radiation with respect to future productivity and reproductivity of the animals. Here again there is very little in print in usable form that will be helpful as a guide to the veterinarian confronted with these situations.

Just how to enlighten the veterinary profession and better prepare it for possible eventualities of atomic warfare is a debatable question. A careful and continuing study by one or more individuals who can evaluate and disseminate information in a form understandable and of direct interest to the unindoctrinated veterinarian seems to be indicated. Possible scholarships for veterinary students or veterinarians sponsored by the AVMA or by veterinary schools offer the best solution.

What the veterinarian should know about atomic explosion

There are several not too complicated things the veterinarian should know about atomic explosion. He should have a general idea as to the capabilities and limitations of an atomic bomb and atomic warfare so that he may understand his own capabilities, visualize possible effects and demands upon his professional service, and soundly appraise his own position in the overall picture. He should have conversational knowledge and some idea as to how the effects of atomic explosion are manifested so that he may understand, converse, and exchange information and instructions intelligently with others engaged in related aspects of atomic explosion and so that he may visualize possible effects under varying circumstances on public health, food supplies, water, and livestock, as well as the agricultural and food industries in general. He should know the sources, characteristics, and differences in action of alpha, beta, gamma, and neutron radiation, because it is only with such knowledge that he will be able to evaluate the situation and give sound advice. It is also necessary for him to understand the requirements for personnel protection and to realize safety limitations. He must understand the types of radiation in order to be able to interpret the significance of any given type or amount present, with relation to his own activity and safety. It is only with such knowledge that he may confidently approach problems in connection with food supplies and animals.

During the past few months, several one-week indoctrination courses in the medical aspects of atomic explosion have been given at the Army Medical Department Research and Graduate School, Washington, D.C. These courses are designed primarily for the medical officer to orient him in the handling of casualties. Medical officers of all services from all parts of the country have attended these courses, and on return to their stations have imparted their knowledge to the medical officers of their commands. A few civilian doctors from medical schools and several Army Veterinary Corps officers have also attended this course.

While this paper has left many questions peculiar to veterinary medicine unanswered, it has given a general picture of what might be expected, and it is hoped that it may stimulate further study and dissemination of information within the veterinary profession on the veterinary aspects of atomic explosion. The imaginative mind promptly visualizes the terrific impact atomic warfare might have on the livestock and food industries and the ramifying studies indicated in connection therewith. Important also are studies of the long-range effects of nuclear radiation on soils, pasture lands, and livestock ; as well as studies as to the possible uses of atomic energy in the peacetime pursuits of veterinary medicine.

Bibliography

Special Projects Division, Office of the Surgeon General, Department of the Army: *What Every Medical Officer Should Know About the Atomic Bomb. I, Introduction to Nuclear Physics. Bull.* U.S. Army Medical Department, S. No. 3, (March 1948), pp. 187-198. (This is the first of a series of ten papers to be published).

Medical Division, U.S. Strategic Bombing Survey: *The Effects of Atomic Bombs on Health and Medical Services in Hiroshima and Nagasaki*, U.S. Government Printing Office, (March 1947).

Chairman's Office, U.S. Strategic Bombing Survey: *The Effects of Atomic Bombs on Hiroshima and Nagasaki*, U.S. Government Printing Office, 1946.

Office of Mr. Bernard M. Baruch, U.S. Representative to United Nations Atomic Energy Commission: *The International Control of Atomic Energy;* Scientific Information Transmitted to the United Nations Atomic Energy Commission—June 14, 1946 to October 14, 1946. U.S. Government Printing Office, *Department of State Publication* 2661.—Reproduced from the *Journal of the American Veterinary Medical Association*, October 1948.

Home Gleanings

OUR NATURAL RESOURCES AND THEIR CONSERVATION

SOME 640 scientists representing 50 nations met in August this year at Lake Success, U.S.A. to study the various problems relating to conservation and wiser use of world's natural resources. Considering the fact that the science of conservation is still in its infancy in India, the contribution made by the Indian delegation at the conference was of sufficiently high order. The American delegates, however, dominated the conference, and rightly so, because it was in America that the technique of conservation and utilization of resources was perfected and put to practice. The American Association for the Advancement of Science was perhaps the first scientific organization to focus the attention of the world to this vital issue. The Americans, however, could not push on vigorously with their programme of conservation until Theodore Roosevelt became President of the U.S. in 1901. The forests which were disappearing very fast had to be preserved. President Roosevelt succeeded in increasing forest reservation of his country to more than 116 million acres, and in withdrawing from private entry another 118 million acres of potentially rich mineral bearing land. It was at his suggestion that the National Conservation Commission was founded in the country, and international conferences were organized to consider this question. In more recent years President Franklin D. Roosevelt was a great champion of the conservation movement. It was during his administration that the famous Tennessee Valley Scheme was formulated and got going. This scheme ranks as one of the spectacular examples of how a country's natural wealth can be conserved, developed and finally improved. The Russian schemes of resource conservation and utilization, as embodied in the series of Five-Year Plans, are much more spectacular examples of what a nation can do in this respect, in spite of initial backwardness, if they have the will to get things done. The Soviet Union has thus been transformed from a poor and ill equipped agricultural country into a highly industrialized State within such a short time as thirty years. The conservation movement is also gaining ground in countries like the United Kingdom. A special Ministry of Town and Country Planning was established during the last war in Great Britain, with a view to conserving and utilizing natural resources which were neglected before.

Natural resources are fundamentally environment functioning in the service of man, and their true appraisal depends upon a number of variable factors such as human wants and human abilities. Forests, soils, waters, minerals and animal life are the essential element of environment, which man exploits for his very existence. Conservation is defined as the course of action which will secure for mankind at least as great a future benefit from the exploitation of environment as is now enjoyed. It therefore includes the protection of the forests, the prevention of soil erosion, the proper utilization of water resources, the careful mining of minerals, and the care of animal life including the fish. The conservation of the human life and culture of the nation is considered to be the most important phase of this movement. Accepting the principle that every nation should now be free to choose its own course of action, the technique for resource conservation must be devised differently for different countries based upon the degree of political and economic independence previously enjoyed by the people. All the above topics were thoroughly discussed at the Lake Success Conference, each delegation emphasizing their special viewpoint.

The conservation of man

One of the fundamental resources of any nation is the skill and energy of its population. Even in the richest country of the world, the United States, the net money value of all the people is found to be twice as great as that of all the country's material possessions of every description. In less developed and more densely populated countries like India the *per capita* money value of man may be less, but the total money value of the entire population amounts almost to an astronomical figure, and is at least fifty times greater than that of the utilizable material wealth of the country. Yet man is left to his fate in India. The productive years of man are, therefore, considerably shortened in India. Every year 34 million children die before reaching their fifteenth birthday, costing the country several hundred crores of rupees. What an enormous drain on the country's resources ! What a tremendous waste of the human material, the greatest assets of India. This question should, therefore, be given the first priority in any conservation programme for India, so that under-nourishment and insufficient education may no longer retard the healthy growth of the Indian child.

Forests, their conservation and utilization

Forests constitute undoubtedly one of man's greatest and at the same time most mismanaged resources. The National Planning Committee of India, therefore, did a very wise thing in appointing a sub-committee on Soil Conservation and Afforestation which started its work sometime in 1939. The very first resolution adopted by this sub-committee was as follows : 'Soils and forests constitute a national heritage. On their successful conservation depend the present and the future of the nation. The State must, therefore, step in and accept responsibility for their conservation'. Originally forests covered at least one-third of the surface of the earth, but due to their ruthless destruction by man, they now hardly cover 9,000 million acres, that is to say, less than one-sixth of the total area of the world. There are records to show that the Sahara desert was forested, and inhabited in the past, and that ancient civilizations once flourished in regions of Asia and South America, are now invaded by deserts.

Clearing of the land for agricultural activities has been the chief factor in forest depletion throughout the world, more so in under-developed countries like India and China which contain more than one-third of the entire world population. In India the dense forests of the Gangetic valley had to be cleared off to give place to the plants favoured by man—wheat, rice, barley—all members of the grass family. The second major factor responsible for forest depletion is lumbering on a commercial scale, as practised in the U.S.A. and Europe. It is reported that the United States alone cuts as much lumber per year as the rest of the world together. Of the other causes leading to destruction of forests mention may be made of forest fire, wind erosion, over-grazing, and insect pests. Forest fires may occur from both natural and human causes. The major natural causes of forest fire is lightning. In India such fires often do considerable damage to forests in summer months. The fire protective measures devised so far need further improvement. For example, the method of early burning of dry fallen leaves, grasses and decayed wood under supervision may minimize the danger of natural fire during the Nor-wester months, but gives rise definitely to soil erosion which adversely affects the growth of seedlings. The disappearance of forests from the Sahara and other man-made deserts was caused mainly by wind erosion. The invasion of deserts into forest lands can early be prevented, if proper steps are taken. Cultivation of natural grasses on land denuded of forest coverings is thought to be most effective in checking the growth of deserts. Hill slopes exposed to violent winds are often devoid of any trees. The Cherrapunji scarp is a classical example of forest land totally damaged by strong gales. Animals grazing in forest land often do serious damage to both seedlings and older trees. In India more than one crore of animals graze every year in State forests. Grazing should be controlled, if forest stands are to remain productive for years. The damage done to forest by insect pests is also preventible.

In the United States, some 387,000 acres of valuable forests were sprayed successfully in 1947 from the aeroplane against the tussock moth.

Forests provide mainly fuel wood and timber for the use of man. It is estimated that the world consumption of these two forest products amounts to 250 million cubic metres per year. Another 250 million cubic metres is consumed annually for feeding industries like paper and rayon, and for various other purposes. Even this heavy consumption falls far short of the present demand for timber and firewood in the post-war world, and the natural tendency today is to fell trees indiscriminately, not knowing that this will hasten the death of the remaining valuable timber stands. Coniferous soft wood forests are now exploited more rapidly than tropical or temperate hard wood forests. The Soviet Union is the only country that has large reserves of conifers for export and future use. Finland and the two Scandinavian countries, Norway and Sweden, are also very rich in soft wood, and have exportable surplus, though consuming more wood *per capita* than any other nation of the world. All the other European countries, though once heavily forested, used up practically whole of their forest resources, and later adopted vigorous forest policy, which included regular planting, scientific strip cutting, complete utilization of all forest products and State ownership or control. As a result of this policy, Germany had more than one-quarter of her area covered with forests, and France, about one-fifth before the last world war.

India is a typical example of what happens when forests are destroyed. Once India had extensive and excellent forests, but now hardly 12 per cent of its area is covered with dense forests, and that too, mostly in inaccessible and mountainous areas. Because of shortage of firewood in the neighbourhood of villages, villagers in India are obliged to use cowdung extensively as fuel. The waste of this good and cheap manure cannot be stopped until forests around villages are restored. Destruction of forests also intensified river floods in India, causing untold sufferings to the millions who lived in flood plains. It is a pity that the previous Government of India did not make any use of their powers under the Indian Forest Act, 1927, for minimizing the evil effects of ruthless destruction of trees by owners of private forests. Now that India has attained independence, it is hoped that the forest departments in the provinces will adopt a more vigorous forest policy for the proper maintenance and utilization of existing forests, and for planting of trees in lands agriculturally unproductive.

Soil and soil erosion

The soils of a country constitute its most valuable natural resource, as it feeds the plants, which provide all the three basic needs of man, food, clothing and shelter. The soil formation is a very slow process, and it takes Nature more than 1,000 years to build one inch of top soil, the most vital part of the soil profile. It should be realized that when this top soil, say up to the depth of six inches from the surface, is removed either by wind or by water or by man for repairing unmetalled roads, the most common practice in India, 6,000 years of Natures' work goes to waste. It is estimated that the U.S.A. loses some 400 million dollars every year because of soil erosion and consequent low productivity of agricultural land. In India about one-half of the agricultural land is suffering from soil erosion. This accounts for shortage of food for man, and fodder for domesticated animal. Since soil erosion can be controlled in a practical way, an effective organization on the lines of the Soil Erosion Service of the United States, should be established in India. The examples of other countries, say France or Italy, can be effectively followed by India in the reclamation of deeply eroded fields for agricultural use, and in bringing again under the plough thousands of acres, now lying waste because of extremely low fertility.

Water resources and their utilization

Man uses water in so many ways that he often takes it to be an unlimited resource like air, and does not take steps for its proper utilization and conservation until he is confronted with a serious water shortage. In any scheme of planning for water resources development, the just apportionment of water between the various

users should be the guiding principle. The order of importance of the various uses of water, as suggested by Throndike Saville in 1935, still holds good. It is as follows: (i) Atmospheric moisture indispensable to organic life, (ii) drinking water for man, (iii) water used in agriculture and husbandry, (iv) water as a habitat of fish, (v) water used for generation of power, (vi) water used for mechanical and chemical processes in industry, (vii) water as a medium for the removal and purification of water, (viii) water as a recreational asset and (ix) water used as ice.

The rainfall of India is so erratic and seasonal that too much dependence on it should be discouraged, and vigorous water policy is to be pursued, as advocated by the National Planning Committee, so as to get the greatest benefit possible from the country's water resources. The sub-committee on River Training and Irrigation had recommended the establishment of a National Water Resources Board for the conservation and utilization of water resources in the country.

Minerals and their conservation

Nature has given to man her veritable treasures in the form of minerals. But unfortunately these resources are not only exhaustible but are also irreplaceable. This fact has been ignored so far and more minerals have been extracted from the earth in the last thirty years than in the whole of previous history. As a result of such intensive exploitation, most of the rich mineral deposits are on the point of exhaustion. Iron, manganese, aluminium and mercury may last for another hundred years, but some like nickel, lead, zinc, gold, silver and diamonds will disappear from the mines within a generation. Hence, it is natural that there should have been a lively discussion at the Lake Success Conference on the problem of techniques for conserving mineral resources. It was pointed out in the meeting by representatives of under-developed countries that measures adopted for conservation of mineral resources in their countries were far from satisfactory, and that their mines were denuded of rich minerals for the benefit of foreign countries. According to Wadia, India alone has supplied 40 million tons of manganese ores of the higher grade since 1900 at a price little above the cost of mining and transport to the consuming foreign countries. It is hoped that the Bureau of Mines, recently established in India, will look into the problem and devise means for the wiser use of minerals. The Bureau of Mines should give first attention to coal and petroleum, the two chief energy producing raw materials. The Industrial Revolution in Britain was made possible by the widespread distribution of the coal-fields, and if in a country like Britain there could be an acute shortage of coal in recent years with the consequent disruption of industry and commerce, the same thing may happen in India in a much worse form, unless steps are taken in time to avert such a crisis. In the petroleum world India's position is critical. The Digboi fields contribute only a fraction of petroleum products consumed in India. Because of India's deficiency in petroleum, agricultural substitutes for petroleum like alcohol from the fermentation of grain and molasses should be manufactured and extensively used. The Bureau of Mines, should also encourage prospecting for petroleum in different parts of the country, especially in the Himalayan foot-hill zone. As to non-ferrous metals, the richer deposits should be conserved and known low grade ore deposits should be opened up. It may be pointed out in this connection that with government subsidy and tariff protection worthless rocks have been converted into rich ores in countries like the United States, the Soviet Union and Germany.

Preservation of wild life including the fish

The oldest occupations of man were hunting and fishing. As a result, very few wild animals are found today except in very inaccessible and remote places. The preservation of wild life, therefore, forms an integral part of the conservation movement. Wild animals should be preserved not only for recreational and aesthetic reasons, but also because they form part of the economy of nature. The drain on wild life in the forests of India has been enormous. As a result, no lions are known to exist in any of the forests, the solitary exception being

the Gir Forest of Junagadh.

Commercial fisheries are divided into fresh-water, coastal and open-sea types. For the world as a whole the fresh-water fisheries are less important than the other types, but it is just the reverse in India at the moment. According to Hora pond culture is a type of animal husbandry which has its highest application in tropical countries and a lucrative industry. According to Srinivasa Rao, another Indian delegate at the Lake Success Conference, exploitation rather than conservation is the immediate problem of marine fisheries in India. With a large continental shelf bordering on three sides in addition to a number of river estuaries penetrating into the land, India has an ideal setting for the development of marine fisheries.—Reproduced from *Science and Culture*, December 1949.

MECHANICAL SCREEN FOR COMPOST-MAKING

A MECHANICALLY operated screen for sieving town-refuse, capable of turning out a ton of finished compost at a cost of Rs. 1-7 only has been designed at the Indian Agricultural Research Institute, New Delhi. The screen is worked in conjunction with a tractor-operated loader which can discharge approximately 10 tons of material per hour into the screen. An elevator which enables the finished material to be loaded direct into waiting trucks or carts has been fixed with the screen so that at none of the stages of operation, manual labour would be necessary to handle the refuse.

The mechanical screen which is an improvement on the hand-operated screen designed previously at the Institute needs only seven men to prepare six to seven tons of finished compost per hour. The new screen is now under fabrication and it is hoped to commence screening operations from the end of March or early in April. (*P.I.B.*)

Book Reviews

OUR PLUNDERED PLANET

By FAIRFIELD OSBORNE (Published by Faber and Faber Ltd., London, 10s. 6d.).

THE author who is the President of the New York Zoological Society has expressed his conviction that the conservation of the natural and human resources of every country must be regarded as a moral obligation.

It is pointed out how misuse of the soil has caused great catastrophic changes in the world and how once very highly prosperous cities have been ruined. Babylon, which was once the cradle of civilization became gradually a desert as the soil conservation practices, such as terracing and addition of available animal and vegetable waste products to the soil, were not subsequently practised for want of man power as a result of nomadic invasion. Similarly, Syria which was once a land of great richness is now a land of ruin. Greece which in ancient times was a region of plenty is now yielding poor crops as a result of forest denudation. In China today the countryside surrounding the Yellow River is nearly all eroded desolation. The Yellow River flows between high embankments at a level well above the surrounding land and threatens to flood and destroy, and often does so, vast areas in China with loss of numerous life.

Some recent examples of misuse of land are given such as may be seen in New Zealand, Australia and the United States. It has taken only six generations to bring widespread conditions of land illness to Australia as well as to New Zealand. Soil loss by erosion on all lands in the United States in terms of money is estimated at $ 3,844,000,000.

If these losses were to go on unchecked, the result would be tragic for America and for the world. A large percentage of India's population has not enough to eat as the land has long deteriorated.

The author has stressed the point that the alarming increase of the degenerative diseases including psychological and neurological illnesses may be related, in a manner yet to be defined, to the steady deterioration and wastage of the top soil. He expresses rightly that man must recognize the necessity of cooperating with Nature. Man must temper his demands and use and conserve the natural living resources of this earth in a manner that can alone provide for the continuation of civilization.

The book is written in a manner easily understood by non-technical men and the facts enumerated are very informative to the students of and workers on soil and water conservation. It should find a place in the library and reading room of everyone interested in the conservation of natural resources and in allround improved agriculture. (S.P.R.)

PROGRESS OF COOPERATIVES IN THE UNITED PROVINCES, 1948-49

(Published by the Cooperative Department, U.P., Lucknow, 1949).

THIS brochure gives in brief the progress of cooperative movement since after the Congress Government took over administration of the province in April 1946. Apart from the cane societies which have done good work in the development and marketing of cane, the cooperative movement in the U.P., till 1946, was primarily directed towards the supply of cheap credit. Attention was, therefore, concentrated on the development of non-credit cooperation and, in consequence, a Development Coordination Plan was put into force in April 1947. Under this Plan, all the field activities of the Departments of Agriculture, Animal Husbandry and Cooperation have been coordinated and worked through the organization of multipurpose cooperative societies. This province has been divided into 921 development blocks for this purpose and for each

block 15 to 20 multipurpose societies have been organized. It is noteworthy that all these societies have been evolved or built up round the seed stores organized by the Department of Agriculture. The management of these seed stores as well as the distribution of artificial fertilizers, formerly done by the Agriculture Department, have been taken over by the multipurpose societies. There are at present 18,000 multipurpose societies in the development blocks. It would appear that there are, besides, 15,000 multipurpose societies outside the development blocks, thus making a total of 33,000.

This seems to be a remarkable development considering that according to what has been stated on p. 5 of the brochure, there were only 20,000 societies of all types in 1946. It seems from this statement that apart from the 33,000 multipurpose societies, there must be quite a few thousands of other types of societies. If this is correct, the progress of the movement seems to be very spectacular having regard to the fact that the Development Coordination Plan commenced functioning only in April 1947.

The first 12 pages of the brochure give, in brief, the progress of non-credit movement in the province during a period of less than two years. The subsequent sections deal with the principal non-credit cooperative activities, apart from a short account on the working of the U.P. Provincial Cooperative Bank. It would appear that a considerable proportion of the development of non-credit cooperation has been due to controls and scarcity conditions. This has been fully recognized and efforts are being rightly directed towards consolidating the working of these societies so that they could stand on their own legs immediately after the return of normal conditions. (T.G.S.)

TRAINING IN FISHERIES

TRAINING in Inland Fisheries which is being given under the auspices of the Central Ministry of Agriculture for the last few years has been extended by another year, and the next training class will start at the Central Inland Fishery Research Station at Barrackpore, near Calcutta, from April 1, 1950.

The Course is of 10 months' duration and covers training in general principles and practice of inland fisheries work. It is primarily designed to train personnel for the posts of Fisheries Officers in the States of the Indian Republic. In addition, candidates wishing to take up private employment or develop their own fisheries may be admitted, at their own cost.

So far, 170 persons have been trained by the Central Ministry of Agriculture in both inland and marine fisheries, and most of them are at present employed in fishery development work in different parts of the country.—*Food Bulletin*, February 13, 1950.

FIG. 1. An animal being injected with tuberculin.

FIG. 2. The thickness of the skin being measured with a pair of ball-pointed callipers.

News and Views

INVESTIGATION INTO TUBERCULOSIS IN CATTLE

A TWO and a half year investigation into the incidence of tuberculosis in cattle in certain parts of Tanganyika is being carried out by the East African Veterinary Research Organization which serves the four British East African Territories of Kenya, Uganda, Tanganyika and Zanzibar.

The investigation is being undertaken at the request of the Tanganyika Veterinary Department because the incidence of the disease has been increasing steadily during the past few years, particularly in the Dar es Salaam district and the Southern Highlands Province. The unit is equipped with a mobile laboratory fitted for the carrying of all reasonable diagnostic techniques.

Mr. A. E. G. Markham, who is in charge of the work, is assisted by a team of European and African veterinary experts. A caravan, fitted with all the necessary equipment for bacteriological investigations, constitutes the main laboratory. Office and living accommodation is provided in another caravan. This arrangement 'on wheels' enables the team to move from place to place without any dislocation of work. The Dar es Salaam operations are expected to last about six months. The Unit will then move to the Southern Highlands Province where the bulk of the work will be carried out. (*B.I.S.*)

GOVERNMENT'S FOOD SELF-SUFFICIENCY PLAN

THE Government's food self-sufficiency plan is concerned primarily with feeding the present population according to the current standards of consumption, and for providing food, according to existing standards, for the gradual increase in population, without resorting to imports after 1951.

The schemes under the food production campaign should, therefore, be considered as remedies for an existing crisis judged by standards of consumption which prevail to-day. Therefore, the only measures which can suitably be taken are those which would produce quick results which are also permanent. It is because of the limited objective of stopping imports that the emphasis is on the production of cereals.

Although before the war India was an importer of rice, mostly from Burma, the food problem became acute when imports suddenly stopped with the Japanese occupation of Burma. It has been one of the foremost Indian problems since 1943. In the same year, the Government of India launched the 'grow more food' campaign, which in its early stages consisted of a number of *ad hoc* schemes, designed to increase food production by intensive cultivation and diversion of acreage from cash crops to food crops. The 'grow more food' campaign, however, was not placed on a planned footing until 1947 when definite targets were fixed for additional food production in each province and the States as a whole. The total targets for the five-year plan were three million tons for the provinces and one million tons for the States. The five-year plan was expected to be completed by the end of 1951-52.

Revised food production plan

Meanwhile, the partition of the country and the increasing food imports have involved a huge drain on the country's foreign

exchange resources. The Government of India have realized that it would mean the economic ruin of India to allow such huge imports of foodgrains to continue much longer. The Prime Minister, therefore, declared last year that foodgrain imports must be stopped by the end of 1951 crop season, i.e. crops sown by the end of 1951 and self-sufficiency achieved by that date. A revised plan of food production was accordingly prepared by the Central Ministry of Agriculture in consultation with the Provincial and State Governments. Taking 1947-48 as the base year, it has been estimated that at the existing level of nutrition the deficit in 1952 would be between 4·5 and 5 million tons.

Aids to better farming

To meet this deficit, which is roughly 10 per cent of the country's total production, the Government of India have carefully considered various schemes for increasing food production. In view of the emergency before the country, such schemes must of necessity be of short duration. The yield of foodgrains in India is low as compared with yields in China and Japan, not to mention the various European and American countries. The quickest method of increasing production in India is, therefore, to increase the yield per acre by employing better farming methods. These can be broadly divided into two main categories, permanent and recurring. The permanent improvements are those which result in an increase of yield per acre for a number of years. They are mainly: (a) Minor irrigation works, and (b) land improvement works. Recurring improvements are those which have to be continued and intensified from year to year so as to achieve a progressive increase in yield per acre. These recurring schemes relate to: (a) Production and distribution of improved seeds, (b) application of chemical fertilizers and green manuring, (c) composting of farmyard manure and town-refuse and its application to the soil, and (d) plant protection.

The quantity of additional production to be achieved by employing one or more of these intensive cultivation practices has been fixed for the provinces and States, after their respective Governments have had the opportunity of assessing their capacity for the increase of food production. These targets are, of course, based on the assumption that the amount of money, men and essential materials required for their programme of food production will be available in full.

Thus, targets have been prepared in respect of each of the *kharif* and *rabi* seasons until the end of 1951. By their very nature these are tentative and will require revision and readjustment. For example, a good monsoon might produce better results from intensive cultivation practices than in another year. Similarly, a curtailment in funds both at the Centre and in the provinces and States might, in a year of financial stringency like the present, result in a reduction of the quantum of financial assistance for the farmers, as well as of the necessary staff and establishment for increasing the production of food. In view of these extraneous factors, it is not possible to forecast with exactitude what quantities of additional foodgrains would be produced in a given year on the intensive cultivation programme.

The reclamation and cultivation of waste lands is another aspect of the food production programme. In the Central Indian regions of the United Provinces, Central Provinces and Berar, Madhya Bharat and Vindhya Pradesh especially, there are large areas of weed-infested land which can be made productive by tractor cultivation. Here land can be reclaimed on an extensive scale. The initial experience gained in mechanized land reclamation in the Ganga Khadir area of the United Provinces and in the Saugor and Hoshangabad districts of the Central Provinces has been promising. This work will continue with the aid of 375 heavy reclamation tractors which are being imported from the U.S.A.

Thus, by a programme of intensive cultivation by the extension of the cropped area in the provinces and States, it is expected to produce the additional food required. Deficits have been carefully assessed and detailed plans prepared to meet them. The gap between production and consumption is not unbridgeable. (*P.I.B.*)

Dr. Rajendra Prasad, President of the Indian Republic, at the Dairy Farm of the Government House Estate. (*P.I.B.*)

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to give milk. For it is known that capacity for high milk yield is a heritable character. If we are to take full advantage of improved practices of rearing and management, it is essential to raise the level of the inherent constitution of the livestock. This is precisely the object of animal breeding. A breeder sets out to obtain in successive generations animals with better and better genetic constitutions for the production of milk thereby creating an increased capacity for utilizing the improved environmental resources. The method of improvement of livestock through successful breeding, thus, has a role as important as and complementary to that of improved nutrition and management.

Among the methods of breeding, the most useful is the one known as Selective Breeding. Today in India, we do possess a few breeds of cattle which have a potentiality for high milk yield. What is necessary is to weed out from these breeding animals with a poor constitution and restrict the propagation to those with an inherent potentiality for high yield. The selection of dams is comparatively easy as it can be based on the earlier recorded performance of the animal itself. Such a performance is, no doubt, affected by environmental conditions but if the animals to be compared have been reared more or less under similar conditions, comparisons based on such a direct 'performance test' may serve the purpose. No such test is possible in the case of the bull for a sex-limited character like milk yield. On the other hand, milk yield being a heritable character the progeny receives contributions to its genetic make-up equally from the sire as from the dam. The sire, thus, affects the performance of the progeny as materially as the dam does. What is more important to note, is that the sire exercises a far greater influence than the dam on the future composition of the herd by virtue of the fact that it begets in the course of a life-time far more numerous calves than a dam does. It is vitally important, therefore, for any breeding plan to have an efficient selection of the sire.

The selection of the sire used to be based traditionally on two considerations, viz. conformation to type and pedigree. It has been a matter of common observation, for instance, that a typical dairy animal differs in certain features of the body from a typical draught type. Comparisons between animals were, therefore, based on scores given to different characteristics. The success of such a method would depend on the correlation between these conformation characteristics and genetic potentiality for milk yield. While such a test is useful in distinguishing the type, its usefulness is limited when making a finer discrimination between two animals of the same type. Comparison of the ancestors or the pedigree test has a surer genetic basis but it is also usually limited by the paucity of information available with regard to their performance. By far the best and the most direct way of judging the worth of a sire is to actually rear progeny from it and see if the progeny do better than their dams. That precisely is the object of our selection of sire. Such a progeny test, however, has to be based on sufficiently numerous dam-daughter comparisons because of the fact that even if the genetic system affecting milk yield were assumed to be of the simplest nature, the milk yield of an animal is not reflective solely of its genetic make-up but is affected by environmental conditions. Consequently, each dam-daughter comparison provides an estimate which is subject to fluctuations and to rely solely on the value of the estimate without making a due allowance for the fluctuation to which it is subject would be misleading. It is in the assessment of this fluctuation and in carrying out an objective comparison between dams and daughters to judge the worth of the sire that statistics comes to the aid of breeders. Statistical methods have also provided an objective method of comparing different sires by means of what are known as 'sire indices'. The statistician has, thus, been of immense help to the breeder in evolving a scientific method of sire selection in place of one which was so much dependent on the subjective judgement of the individual breeder.

The value of this new procedure was vividly demonstrated when, in 1943, an investigation was undertaken into the success of the breeding policy adopted in one of our Council's schemes, viz. the Goat Breeding Scheme which had been running at

Etah for over ten years. The object of the scheme was to breed improved goats of certain breeds in respect of milk yield. The scheme started with a foundation stock of a certain number of bucks and does and throughout the scheme progeny were raised without making any cullings. For the first few years everything went apparently well, and the annual output of milk per head was reported to be increasing. This in itself was a wrong basis for assessing the progress of a breeding scheme, the success of which has strictly to be judged from the comparisons between the performances of different generations of animals. When the statistical investigation into the results of the scheme was carried out, it was revealed to the surprise of all, that not only had there been no improvement except in the F_1 generation but that in subsequent generations there had been significant deterioration. None of the sires could be adjudged as capable transmitters as revealed by the progeny test and there was little scope for selection among the does also. The apparent improvement in the annual production in the earlier years was attributable to the contribution to the herd average made by F_1 animals in their peak lactations. The statistical findings were further corroborated when even the annual herd averages subsequently started decreasing as larger numbers of F_2 and F_3 animals came into milk. Had this investigation been made during the early part of the scheme, much money and time would have been saved. All the same its results have led to an increasing recognition of the value of progeny testing in future breeding programmes. In drawing up the programmes of the Council's breeding investigations, increasing attention is now being paid to the statistical considerations involved and every attempt is made to chalk out a systematic and rational plans of breeding, the results of which can be gauged objectively at progressive stages of its execution.

Yet, it must be added that in the field of animal husbandry as a whole, the position is still far from the ideal in the matter of utilization to the fullest extent of the help which modern statistical tools are capable of offering. The sister science of agriculture is more happily placed in this respect. The preponderance of articles pertaining to the latter as compared with those on the former subject in the issues of the Journal of your Society is in itself an evidence of the fact. No doubt the traditional hesitation of the animal experimenter to adopt innovations is partly to blame for this lag. In my opinion, however, the role of the statistician does not end with the forging of the statistical tools but it is equally his responsibility to induce their correct application in the appropriate situations. The reluctance of the animal experimenter to take risks with new methods may be explained by the fact that experiments with animals are on the whole expensive and of long duration. A concerted effort is needed to remove the doubts of the workers and convince them of the usefulness of the tools in planning programmes and assessing their results. The best manner of doing this appears to be through frequent discussions of their problems and through practical demonstrations of the successful use of techniques in actual cases. I shall be very happy to see your Society give a lead in this matter by devoting increasing attention to this subject both in the course of your meetings and in the valued Journal of your Society.

Original Articles

CLIMATE AND ANIMAL HEALTH

By D. N. MULLICK

RECENT declarations about the self-sufficiency in food and to feed every Indian with a pound of milk daily, draw attentions of all the research workers in animal husbandry. A team of workers in physiology, nutrition and genetics has to go simultaneously to explore ways and means to reach the goal. Much progress has been done during the last two decades in the fields of animal nutrition and animal genetics and in its application in the improvement of the livestock. By strictly adhering to the recommendations of the scientists, the farmer often experiences difficulty in achieving the upper production levels in milk, meat, work and fertility to their expectations. It had also been shown that the best breeds from dry extreme climate in Northern India fail to produce the same performance in the moist temperate zone in the south, though the feeding and management were under expert supervisions. Even in a country like America, the total milk production per cow in the south and north was 3,200 lb. and 4,900 lb. respectively, the lower yield in the south being due to the tropical conditions of the region[1]. The internal physiological processes in the body of the animal are dependent not only on its nutrient supply and heredity but also on other factors which may be called climatic factors like, air temperature, moisture, movements, light and so on. These factors are as important as nutrition and heredity. Thus, the low production of milk, meat, work, fertility, long inter-calving periods in milch animals and the delay in attaining puberty in heifers are partly due to unfavourable temperature of the place which results in a great economic loss to the farmers.

[1] *Vet. Med.* pp. 45, February, 1948.

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Adaptation

By different physiological mechanisms farm animals can maintain their body temperature within a very narrow range, though they are exposed to a wide range of environmental conditions from zero or even below 0°F. to 120°F. During winter, animals maintain constant body temperature by putting on more fur, feather or hairs, by accumulating thick layer of fat, consuming more feed, increased muscular activity and by some other physical and chemical mechanisms. They avoid direct wind, seeking out the direct sunshine and huddling together. Thus cattle, sheep, goat, and horses winter outdoor at 0°F. without harm and without lowering body temperature. On the approach of hot summer, hair and subcutaneous fat become thinner, the animal consumes less feed and more water, avoids hot sun, seeks shelter and decreases muscular activity. Non-sweating species like buffaloes keep cool with the help of mud wallows or other moisture that may be available. Animals with poorly developed sweating glands, like cattle, sheep and dog, regulate their body temperature through respiration which may increase to panting with the increase in air temperature. The animal protects itself against hot summer simply by reducing heat production by taking less food and low level of muscular activity. The energy derived from the lower intake of food is spent in the heat regulation and the little balance is converted into milk, meat and work ; perhaps this may be the physiological explanation for the lower production under tropical conditions. The long range effect of high temperature is to reduce the body size, to develop sweat glands, to reduce

the fat, to reduce the heat production by reducing the muscular activity and food intake and to develop protective colouration against light and heat. Animals suffer more in summer than in winter months and there is a great financial loss to the farmer owing to the low production under tropical conditions.

Investigations at Izatnagar

Owing to the importance of this subject to the health, well-being and general usefulness of animals, much attention has been paid to this problem by the research workers in the Indian Veterinary Research Institute since 1941. The investigations have shown that healthy animals on normal diet developed tropical anæmia and sterility in summer months (May to September[2-3]). The animals with higher respiration and pulse rates and higher body temperature consumed less food and more water[4]. Recently, it has been observed that pulse, respiration, body temperature, live weight and hæmoglobin in the animals changed with the change in the air temperature and the moisture. Of all these the change in the respiration rate was most prominent as a result of the change in the climatic condition. Further, the moisture in the air above 80 per cent was found to be responsible for the changes in the pulse and respiration rates. Below this limit it had no effect and only air temperature played an important part in their variations[5]. Another experiment showed that buffaloes have the worst heat-regulating mechanism in the sun but they are better heat-resistant in the shade, and if they are splashed with water for a short period the quantity of milk can be increased. In hot summer months, the fat percentages in the dairy herd at Izatnagar are reduced. It is therefore more important to devise methods for keeping animals cool in hot summer than warm in cold winter.

Research workers always prefer to get maximum yield from the animals by putting them within what is known as a 'comfort zone' where the environmental temperature is perfectly adjusted to keep the body temperature normal without the help of any physical or chemical mechanisms. In this zone, the animals utilize the total feed energy for complete conversion into productions, namely, milk in the case of lactating animals, work in the working animals and semen in the breeding bulls. At present, there is no easy technique to find out the 'comfort zone' for application in the improvement of the livestock.

Remedy

As a remedy for higher temperature menace, the scientist can think of three major methods for increasing the resistance or adaptation or acclimatization of animals to higher temperature. One is engineering—involving control of the private climate of the animal, that is putting up in the cooling system where it can live within its 'comfort zone' temperature, second is biological—by crossing the heat-resisting or sweating cattle with non-sweating animals and the third is to find out some suitable feed or mixture of feeds which have cooling effect in the animal. Considering the vastness and the economic condition of the country, it is not possible to utilize the advantages of the first one, for the enormous cost involved but as an alternative the following suggestions may be utilized against the bad effects of the higher temperature :

(1) The grazing habits may be changed, allowing the animals to graze in the morning till 9 to 10 a.m. and after 5 to 6 p.m. The best, of course, will be night grazing to avoid the highest temperature of the day.

(2) The sweating species give out heat by vaporization from the skin and lungs, the non-sweating animals, like cattle and buffalo, dissipate heat only through respiration. If the direct sun or hot wind comes in contact with the skin, instead of vaporization, heat is absorbed in the body and thus increases the body temperature. The best way to avoid the bad effect is to cover the body in the hot days with wet blanket or hessian to protect the skin from hot sun or *loo*.

[2] Pal, A. K., Momin, S. A. and Mullick, D. N., *Indian J. Vet. Sci.*, **15**, 119, 1945.

[3] Mukherjee, D. P. and Bhattacharya, P., *Proc. Indian Sci. Cong.*, 1947.

[4] Mullick, D. N., *Ame. J. Vet. Res.*, **10**, 1949.

[5] Sinha, K. C., Minnett, F. C., *J. Animal Sci.* **6**, 258, 1947.

(3) The milch animals should be splashed with water for at least 15 to 20 minutes every day to keep cool.

(4) Sufficient amount of greens and water should be given.

The above suggestions are meant for the poor farmers who cannot spend much money on farm animals. For bigger concerns, like the milk production centres at Delhi, Calcutta and Bombay where there is no dearth of money, a careful selection of farm animals for higher productive levels be made ; otherwise unfavourable temperature inhibits the realization of desirable potentialities.

Selection of suitable breeds

It is a matter of general observation that certain breeds of animals are non-resistant to certain environments than others as judged by body weight, performance, milk production, fertility, etc. In order to find out the best suitable breed for the maximum production in a particular climatic condition, the following suggestions may be considered :

(1) Monthly respiration rates of various breeds which are suitable for a particular purpose (milk or work or breeding) are recorded. The breeds which show the maximum variations in the respiration rates during the summer and winter months are the worst animals for the local climate. The breeds of least variations are the most suitable for the place.

(2) To bring the youngs of best breeds within six months of age to a particular place and allow them to be acclimatized to the local environment. The heat-regulating mechanism in young animals is not fully developed and so it is easier for them to be acclimatized to any environment in which they are allowed to grow.

(3) Grading up with improved males the native females because selection within a native type has certain advantages as the local breed is already acclimatized to the environment. The disadvantage is that the progress is slow.

The above suggestions hold good only when the nutrient supply and management are satisfactory.

From the above, it will be realized that climatic factors need equal consideration with nutrition and heredity in livestock improvement.

OBSERVATIONS ON *BAJRI KANKER* IN THE SUBSOIL

By BISHAN MANSINGH

IN the year 1935, paddy cultivation was started on partially reclaimed usar lands at Bilanda and Habib Farms. *Bundhis* and tanks were constructed to store rain water for irrigation. After the first rainy season it was observed that earthen embankments at both the places contained large quantities of small pieces of *kanker* locally known as *bajri* ; and are still present in the mounds of these embankments.

The soils of *bundhis* and the tank were similar to those of adjoining paddy fields and neighbouring lands, but the presence of *bajri* in paddy fields did not produce any adverse effect on paddy cultivation, nor in the growth of rank vegetation on the usar land adjoining paddy fields. This vegetation appeared where none existed before, and improved due to the holding of rain water on the land.

Owing to the presence of *bundhis* at Bilanda Farm and strong field embankments at the Habib Farm, the uncultivated usar land remained under water for long periods during rains every year. The collected water was, no doubt, let out almost every fortnight to wash out injurious salts.

At first, I had no idea that *bajri kanker* was also slowly dissolving in the usar land which was being reclaimed according to my method.* All that I saw was that my paddy crops were very good, coarse vegetation appeared on those spots which had none before ; at those places where only sparse vegetation was seen during rains thick vegetation appeared, and lastly the drying up of grown up trees stopped altogether. Last year, my *bundhis* were being cleared of silt for the first time. When I went to inspect the work, I observed that inside the *bundhis*, where water remained for about four to five months in the year, the number and size of *bajri kanker* were greatly reduced and the edges of *kanker* had smoothened.

I reported this observation to Mr. V. L. Verma, M.Sc., of Kanpur Agriculture College who had previous experience of reclamation work under Dr Dhar of Allahabad University and was well-acquainted with my work at Bilanda Farm and other places.

Mr. Verma very kindly visited my *bundhis* at Bilanda Farm and the tank at Habib Farm. His opinion was that this slow dissolving of *kanker* was probably due to the fact that the chief constituent of *kanker* was calcium carbonate which is not soluble in water, but it changes into calcium bicarbonate in the presence of soil water which is soluble in water, and this slow dissolving of *kanker* was probably due to the above fact. Dr B. K. Mukerji, Agricultural Chemist to the Government of Uttar Pradesh, concurred with this view.

Bajri kanker is generally found in alkali soils whose *p*H value is over *p*H7 and up to *p*H10 according to the intensity of alkalinity in the soil and, thus, the problem for me was to find out some means by which to reduce the calcium carbonate content of the soil.

Cultivation of paddy and holding of water on adjoining lands on which vegetation was developing, continued in both of my farms and dissolving of *bajri* was also proceeding, although unnoticed by me, but since both Dr Mukerji and Mr. Verma were not quite definite in their opinions about the cause of dissolving of *bajri*, I continued my efforts in this direction.

On reading *Soils and Manures* by E. J. Russel, I thought that the real cause of the dissolving of *kanker* in my farms was not merely water but the presence of carbon dioxide in the soil which was increasing through cultivation of paddy and the development of vegetation in the farms. Sir John Russell writes, 'One million parts of pure water dissolve only 13 parts by weight of calcium carbonate at 10°C. but one

* *Indian Farming*, Vol. II, October 1941.

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million parts of water saturated with carbon dioxide dissolve about 900 parts. The explanation is that the calcium carbonate is changed by carbonic acid into mere soluble calcium bicarbonate. Rain water contains some carbonic acid and soil water still more ....' (pp. 20-21). On page 29, he further says, 'Cultivation and cropping ensure production of carbonic acid in the soil'. Again, on page 35, he says, 'Soil air in arable land contains carbon dioxide 0·3 per cent by volume, while in pasture it is 1·6 per cent by volume'. He further writes on page 56, 'As rain falls on to the land and soaks in, it dissolves out soluble substances and carries them away.....The constituent removed in largest quantity is calcium carbonate'. Then he writes on page 170, 'On chemical grounds one would expect that a dressing of 1 cwt. sulphate of ammonia would thus cause a loss of 1½ cwt. calcium carbonate from the soil'.

I apply ammonium sulphate moderately along with compost to my paddy fields on the reclaimed usar land. According to Russell it reduces alkalinity and calcium carbonate content of the soil (pp. 170-174).

In view of these facts mentioned by such an eminent authority on agriculture, it seems that it is quite possible to dissolve *bajri kanker* in our soils by cultivating paddy crop or by growing any vegetation on such soil, provided our rainfall is ample and land remains under water for moderately long periods.

This theory is supported by the very common practice among our experienced gardeners that they plant a plantain plant in the same pit with a valuable tree like graft mango, when they suspect *kanker* in the subsoil, with a view to dissolve it.

My long and continued experiments at Bilanda and Habib Farms have shown that alkali lands and soils containing *bajri kanker* need not be taken to be irreclaimable. Cultivation of paddy and growing of indigenous grasses for fodder and afforestation of indigenous trees such as *sheesham*, *babul*, *neem*, *ber*, *mahua*, *rian* and *dhak* can be profitably and economically carried on. If only grass is grown, grazing must be controlled.

The period of reclamation is no doubt rather long but the cost is insignificant and the farmer begins to get a return from the third year and in some cases earlier.

As the area of this kind of land is considerable and spread all over the State, and being considered as 'impossible' is left as it is, the problem of its reclamation is very important and needs further investigation by soil scientists.

OMISSION

It is regretted that the acknowledgment for the Cover Illustration appearing in the February, 1950 issue of *Indian Farming*, which was very kindly supplied by Shri A. K. Chowdhary, was omitted through oversight.

Ed.

NEW STRAINS OF PULSES AND MILLETS IN BARODA STATE*

By G. K. GOVANDE

PULSES and millets occupy a large acreage in Baroda State and are of great local importance, as these form staple food of the masses. The Pulses and Lesser Millets Improvement Scheme, partly financed by the Indian Council of Agricultural Research, came into operation in the year 1943-44 and was run for a total period of six years coming to a close in the year 1948-49. The scheme was undertaken with a view to evolve new types of pulses and millets which would give higher yields of grain than the local crop.

The work was restricted to *tur* (*Cajanus indicus*), *moth* (*Phaseolus aconitifolius*), and *guar* (*Cyamopsis psoralioides*) in pulses and to *kodra* (*Paspalum scrobiculatum*) and *bauto* (*Eleusine coracane*) in millets.

Baroda State is divided into four districts, the soil and climatic conditions of which vary from one another. The work was carried on at two main experimental stations, namely, Baroda in the Baroda district and Jagudan in the Mehesana district. The soils at both the stations are alluvial or sandy loam known locally as *gorat* soils. The main difference between the two stations is that the average rainfall at Baroda is about 35 in. while that at Jagudan is about 21 in. These two stations were further supported by Vyara in the Navasari district and Deodarda and Vijapur in the Mehesana district.

Following are the results achieved in different crops :

Moth : Baleswar 12 and Medhi 33 are the best strains, the former giving 180 lb. and the latter 99 lb. more yield of grain on average than the local crop per acre. The average yield of the local crop is about 500 lb. per acre. The protein contents of Baleswar 12 and Medhi 33 are 23·98 per cent and 23·28 per cent respectively while that of the local crop is 22·93 per cent. These two strains are suitable for different tracts of the Mehesana district.

Guar : Selection Malosan 40 has given on average 75 lb. more yield of grain per acre than the local crop. The protein content of Malosan 40 is 28·55 per cent while that of the local crop is 29·93 per cent. Slight lower protein content of Malosan 40 is negligible when its higher yielding capacity than the local is considered. This selection is suitable for the Mehesana district.

Tur : No conclusive results were obtained ; however, selections Dehgam 36 and Vijapur 49 for the Mehesana district and Mass selected bulk for the Baroda District seem to be promising.

Kodra : Selections Baroda 8 and Baroda 15 at Baroda, have, on average, yielded 302 lb. and 227 lb. of grain more per acre respectively than the local crop. The average yield of the local crop is 675 lb. per acre. These strains are also superior to the local in respect of yield of straw. Selection Vyara 31 tried at Vyara, in the Navasari district, the black soil and heavy rainfall tract, appears to be promising.

Bauto : Jagudan 44, a selection made at Baroda, gives on average 17 per cent more of grain yield than the local. The average yield of the local crop is 1,000 lb. per acre.

The above strains have been evolved as a result of experiments carried out at different stations. Where there are more than one strains with yield and other characteristics superior to the local, the further choice for multiplication and distribution between such strains or the delimitation of tracts to which different strains may be confined becomes a matter of extensive testing under cultivator's conditions. These strains have been given in

* The State has since been integrated with Bombay.

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the districts for ascertaining their suitability and performance under cultivator's conditions this year.

The above strains, when prove their worth in the cultivator's plots, will cover an area of about 150,000 acres, besides the large adjoining area of Bombay State, with which the Baroda State is now being integrated. The net result will be a large food production with an increased income to the cultivators, even if the extent of improvement expected at present is partly realized.

LOCUST SITUATION

THERE was no locust activity in India during the week ended April 22. Pakistan reports heavy and widespread breeding in D. I. Khan (N.W.F.P.) and some Western districts of the Punjab. Because of rains and dislocation in transport there, control work has become difficult. However, no fresh adults have been noted so far. Swarm movement and breeding on a small scale has been noted in South Persia also. Thus the threat of locust invasion to India is becoming real, particularly from the N.W.F.P. and the Punjab side of Pakistan. Therefore, the anti-locust organization in N.W. India, particularly PEPSU and Punjab, has been asked to be ready for immediate action.—(*P.I.B.*)

ECONOMIC IMPORTANCE OF FOOT-AND-MOUTH DISEASE

By C. SEETHARAMAN

FOOT-and-mouth disease is of world-wide distribution and is never absent from India and has great economic importance because of the serious monetary loss to cattle owners through reduced working capacity of the affected animals, loss in flesh of the slaughter cattle and reduced milk yield of the affected milch animals. In addition there is interference in the cattle trade and there is also the loss caused by actual mortality among the young stock as well as among the pure and cross-bred adult animals.

Foot-and-mouth disease is an acute, contagious, infectious disease caused by an ultra-visible germ or virus which is too small to be seen even with the most powerful microscope. The disease is recognized by fever and formation of vesicles in the mouth and in the clefts of the bovines. In milch cattle the udder and the teats may also be affected showing blisters over the surface. The disease is chiefly seen amongst cattle though it may be found in sheep, goats and swine. It has been occasionally observed in man. It is usually not highly fatal and the death rate does not exceed one per cent in cattle. It may be little higher in sheep and pigs in which the disease manifests itself in a more severe form.

The mode of infection is generally by direct contact, the germ being conveyed through saliva from affected to healthy animals in sheds or at pasture. Indirectly the disease may be conveyed through attendants, contaminated food, drinking water, mangers, roads, hides of affected animals, wool, milk, milk products, etc.

In India outbreaks of foot-and-mouth disease occur at frequent intervals and from the data obtained from different States, it is estimated that nearly 3·5 lakhs of animals are annually attacked by this malady. The enormous loss to India where agricultural operations mainly depend upon bullock power, may be summarized as follows.

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Loss due to actual mortality

Actual mortality due to foot-and-mouth disease amongst cattle in an outbreak is reckoned as one per cent but it may be little more in young stock. Deaths are generally due to degenerative changes in the heart or other diseases flaring up either during the course of the disease or subsequent to it. From the data available, the total annual mortality from this disease amongst cattle in the Indian Republic is approximately 4,000. If on an average the cost of an animal is one hundred rupees the total loss due to actual deaths approximates rupees four lakhs.

Loss due to reduced working capacity

From the available cattle census it is observed that there are 4·3 crores of working animals, i.e. bulls, bullocks and he-buffaloes; 4·2 crores of milch cattle, i.e. cows and she-buffaloes and 3·8 crores of young stock. Assuming that all the classes of the stock, young and old are equally affected, the number of animals proportionately affected in each category would be roughly as follows:

Bulls, bullocks and he-buffaloes	128,500
Cows and she-buffaloes ..	.. 125,514
Young stock ..	.. 113,560

Wright (1937) observes, 'Assuming that the total of India's output of agricultural produce approximates 2,000 crores of rupees, the share of cattle labour would be 300 to 400 crores of rupees'. The present day value of cattle labour would be roughly 1,000 crores of rupees. In assessing the cattle wealth of Indian Republic one can safely value it at about 800 crores of rupees. Inasmuch as 128,500 head of cattle of a total

of 4·3 crores of working cattle are affected, and assuming that due to an attack of the disease the draft power of the affected animal is reduced to two-thirds of the total and as such the monetary loss to India approximates rupees 80 lakhs.

It is common to find three to five per cent of the affected animals turning out to be panters, i.e. on an average 10,500 head of cattle are permanently invalided. Thus, the loss on this score would be some 21 lakhs of rupees. Secondly, the affected animals will be unfit for draft purposes for about a month, i.e. nearly one-twelfth of the total value of cattle labour, which comes to about 20 lakhs of rupees. So the grand total of the financial loss in working capacity would be in the neighbourhood of rupees 121 lakhs.

Loss due to reduced breeding capacity and loss in flesh

From the data available it appears that the proportion of bulls to cows in Madhya Pradesh is 1 : 3 and assuming that in general this may be the case, the number of bulls affected approximates 41,838 and financial value of such animals would be rupees 1·3 crores, assuming the cost of an animal as rupees 300.

Since, there is no authentic information available to measure the loss in breeding capacity of the affected animals, it may be assumed that their breeding capacity is reduced to about nine-tenth of the former, resulting in a loss of rupees 13 lakhs. Secondly, there are a certain number of cows which may abort as a result of the disease. Assuming the number of such animals to be one per cent of the affected ones, the number of cases in this category would be approximately 1,260 with a total financial value of rupees 2·5 lakhs at the rate of rupees 200 per animal. Now, let us assume, that one abortion is responsible for reducing the value of the animal by 50 per cent, and thus, the total loss due to abortion in the affected animals would be rupees 1·25 lakhs. So the net loss due to reduced breeding capacity would be rupees 14·25 lakhs.

After an outbreak of foot-and-mouth disease the animals often become weak and lose flesh. On the average about 3·5 lakhs of animals fall a prey to the disease. Perhaps ten per cent of such recovered animals might find their way to slaughter houses. Assuming that on an average, the loss in flesh is about 20 lb. per individual and the cost of flesh per pound is annas four, the total loss in this respect would be rupees 1·75 lakhs.

Loss due to reduction in milk yield

Roughly we know that about one-third of the milch stock is usually in milk at a particular time and the disease in such animals is attended by a serious drop in milk yield which may persist throughout the lactation period and in some cases the deterioration in milk may be permanent and progressive over succeeding lactations.

From the data, collected by the Indian Council of Agricultural Research from the Military Farms Department, it is found that the losses in milk yield of the affected cows are about 50 per cent and according to the *Marketing Report on Milk* the annual milk production in Indian Republic is 4,629·42 lakh maunds. On this basis the total number of affected cows in milk will produce 13·8 lakh maunds. Assuming that the yield is reduced by 50 per cent and the cost of milk eight annas a seer, the total financial loss would amount to rupees 1·4 crores.

Thus, the total financial loss on all the scores as a result of the disease is about 2·46 crores of rupees. These data, even if they are but reasonable approximations, indicate what foot-and-mouth disease costs India. The national prosperity could be greatly enhanced if adequate control measures are evolved. Research into the possibilities of control by vaccination is now being undertaken at the Indian Veterinary Research Institute, Mukteswar-Kumaun.

RHEA CULTIVATION IN ASSAM

By P. M. GANGULI

ASSAM is one of the areas in India where *rhea* (*Boehmeria nivea*, Hook and Arn) grows naturally and best. Although, it is now grown commonly for the manufacture of fishing nets, a new industry for Assam may spring up within a short period, if an economical method of extracting the *rhea* fibre is perfected. America is said to have evolved a decorticating machinery which will only operate when the stalks are green. Australia, however, claims to have a machine which will deal with stalks at every stage. The *rhea* fibre is of a much superior quality with a high tensile strength.

Method of cultivation

Rhea is generally propagated by slips. Ordinary cuttings may also be used, but they take some time to establish. These are seen to flower, but no trial has yet been made here to grow them from seeds. The slips are planted with the first showers of rain in April. Heavy manuring of the field with cowdung or compost will be necessary for a quick and luxuriant growth. The site should be so selected as to avoid all chances of water-logging. Once planted they will go on spreading year after year and continue in the same place for an indefinitely long period. In fact, a plot of *rhea* was seen in Charai Bahi, a village near Barbheta, where it was planted about 50 years back and nobody knows when it will cease to grow. The only precaution they seem to take is to spread some dried straw and cowdung over the field after harvest and to protect the crop from the damage by cattle.

Harvesting is done two or three times a year during the period from May to October. After the last harvesting in October the growth becomes slow till there is again a flush of growth with the first showers of rain in April. The crop is harvested when the stalks are 5 ft. or more in height and the lower leaves begin to dry up. In no case the crop is allowed to ripen.

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Extraction of fibre

After harvesting, the outer layer of the bark is removed either by scrubbing the stalks with a rough gunny or by scraping with a blunt knife. The stalks, thus cleaned, are then allowed to dry in the sun for two or three days. If the stalks cannot be dried immediately after cleaning due to bad weather, a fungus starts growing on the stalk and colour and quality of the fibre deteriorate. The crude fibre is then extracted easily by breaking the dry stalk at the base and pulling out the fibre. The average yield of such fibre is about three maunds per acre for each harvesting. The cultivators generally sell them off at this stage to the fishermen at Rs. 6 or so per seer. This crude fibre is good for making ropes only. For making it useful for other purposes, such as, for spinning into threads for manufacturing the fishing nets, it is to be washed and cleaned further.

Use of the fibre

The fishermen, generally, do not have enough homestead lands to grow *rhea* or enough time to take out the *rhea* fibre which is no doubt a laborious process. Some of them, however, have started growing *rhea* in their homesteads on a very small scale. Consequently they get the main supply of the crude *rhea* fibre from other villages. This crude fibre is washed and cleaned by them by beating against a plank and dried in the sun. There is no degumming actually. *Rhea* threads are prepared by the fisher-women by spreading the fibre over a *jiona* (a small bamboo frame for combing the fibre) and spinning the same by a *takura* or *takli*. Three-ply twisted threads are ultimately made for making the nets. The *rhea* nets last at least twice as long as the cotton nets and are priced at Rs. 10 per seer; though generally the quantity is just enough for personal use.

USE OF POWER-DRIVEN SPRAYER IN THE CONTROL OF MANGO HOPPER IN THE PUNJAB

By GURCHARN SINGH SODHI and AUSHI LAL BATRA

MANGO is the most popular and extensively grown fruit in the Punjab. Of the total area of 49,553 acres under orchards in the Punjab, 33,788 acres, or roughly 68 per cent, are under mangoes. Hoshiarpur district, where area under this fruit is estimated at 10,146 acres (33 per cent of total), can derive an income of about 10 lakhs of rupees from the mango orchards alone. But, unfortunately, mango hopper (*Idiocerus* sp.)—a serious enemy of mango—plays havoc with the mango crop. The nymphs, the emergence of which synchronizes with the appearance of the inflorescence, suck the sap from the floral shoots during the months of March-April and devitalize them, with the result that these shoots wither. This naturally results in a great reduction in yield and it is not uncommon to see the entire plantation devoid of any fruit. The orchardists, thus, suffer a great loss. Successful control of this pest in the mango orchards is, therefore, the urgent and immediate need not only of the individual mango growers but also of the province, which is already deficit in fruit production. It was to meet this demand that the present trials, the results of which are discussed in this paper, were conducted at Hoshiarpur during 1948-49.

Need for power sprayers

Practically, all the area under mangoes in the Punjab is planted with seedling trees, without any regard to modern horticultural practices. The trees, as a result, are too closely planted and have, therefore, attained a height of 40 ft. to 50 ft. Four Oak Spraying Machines, fitted with long spraying rods, were used in earlier trials and it was found that it was not possible to spray the entire mango tree with these machines. In fact, it is not at all feasible to spray such high plants with any hand-worked spraying machine, available at present. So, use of power sprayers became a necessity for combating this ever-increasing menace effectively. Orchard power sprayer was, therefore, tried (at first in the united Punjab). It gave an efficient spray, but, being too heavy, it could not be moved easily. Consequently, its output was low and cost high. The Department of Agriculture, Punjab, hence, arranged through the Central Government, the import of the Bean Model, Royal 20, power sprayers, from the United States of America. These were tried at Hoshiarpur (East Punjab), during 1948 and 1949.

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Brief account

A Bean Royal 20 has a cold start internal combustion, four-cylinder, Wisconsin engine of 12 h.p. It is air-cooled, and provided with magneto ignition with a throttle governor and a handy speed control. A tank of 300 Imperial-gallon-capacity equipped with a quick-charge large capacity strainer box, giant filter and an agitator, is fitted to it. It can develop a pressure of 600 to 700 pounds and can throw water at the rate of 20 gallons per minute. It has an improved filtration system to ensure freedom from blocked nozzles and a new type variable nozzle, especially developed for automatic spray—giving spray range from a fine cone to a high power jet of 40 to 50 ft. in length. The guns have adjustable settings to ensure good cover on all types of orchard trees. Two rubber hoses, each 50 ft. long with spray guns, are tightly fitted at the rear end of the tank. The machine is on wheels, fitted with pneumatic tyres.

Working

It is a bullock-driven machine, which can be easily drawn by a pair of bullocks of average

Charging the tank with water and insecticide. (Plate 32). →


PASHABHAI
PATEL & CO.
BOMBAY

strength. As the sprayer, at present, is not fitted with any suction arrangement for sucking water into the tank, the required quantity of water has to be poured through the top opening. Four men take, on an average, 25 minutes to fill the tank (300 gallons). Of these four men, two draw water from the well, one catches the bucket and hands it over to the fourth, who pours water into the tank (Plate 32). The insecticide is then poured into the tank after which the machine is taken to the place of spraying (Plate 33). The time taken for this will, of course, vary according to the distance of the well from the place of action. The rubber hoses are then removed from the hangers and unrolled. One man is put on holding each rubber hose at its middle during spraying and another holds the spraying guns and does the spraying work. The engine uses kerosene oil of 35-octave rating. It is started with petrol and then put on kerosene oil. When the engine develops the desired pressure, the spraying of trees is started. The spraying guns are adjusted according to the height at which the spraying material is to be thrown (Plates 34, 35). The machine is moved from one row of trees to another and the engine continues to work till the insecticide in the tank is exhausted. The tank is emptied of its contents in 15 to 16 minutes. The engine is then again put on petrol and stopped. The power sprayer is brought back from the place of action to the well, the tank is then recharged with water and insecticide and spraying operation started as before.

All the operations from charging the tank with water, etc. up to its bringing back to well, take about 60 minutes during which period the engine actually works for 15 to 16 minutes and sprays about 50 big sized trees. So in a day of six working hours, the sprayer sprays about 300 trees and the engine actually works for about 1½ hours. During this period, the engine consumes 1 gallon of petrol, 3 gallons of kerosene oil and ¼ gallon lubricating oil.

Application of insecticide

So far, winter spraying with rosin compound was recommended in the Punjab to kill the hibernating adults but in spite of the application of this insecticide, considerable damage was done during the following spring, by the progeny of the surviving adults. The discovery of a cheap and more effective insecticide had, therefore, been engaging the attention of the Entomological Section of the Department of Agriculture, Punjab, for the past several years.

During March 1948 and 1949, DDT (Guesarol 550) obtained from the Geigy Insecticides Limited, Bombay was given an extensive trial against this pest at Hoshiarpur. In a statistically planned experiment at Hoshiarpur, the mango hopper nymphs were first effectively controlled by spraying the inflorescence of grafted trees with 0·15 per cent DDT. The initial population of nymphs per one inch of inflorescence which was found to be 4·98 and 10·3, was reduced to 0·025 and 0·7 within 24 hours of treatment during the seasons of 1948 and 1949, respectively, on the sprayed trees. Residual effect of the insecticide lasted for over five weeks, during which period the population of nymphs per one inch of inflorescence in the treated trees varied from 0·0 to 0·1 nymphs as against 3·8 to 6·8 nymphs on unsprayed trees during 1948 and 0·2 to 0·7 as against 8·7 to 19·6 respectively during 1949. Thus, one spraying was enough to successfully control the pest at a cost of annas two only per average sized grafted mango tree. DDT spray had absolutely no adverse effect on the setting of fruit—rather it helped increase the setting and decreased the shedding, which occurred in the infested inflorescence as a result of its low vitality caused by the constant feeding of nymphs on the cell sap. On an average, 29·7 fruits were recorded on a single sprayed floral shoot as against 10·6 on an unsprayed one, after three weeks of spraying during 1948. This number was further reduced to 2·4 and 0·5 respectively within six weeks of spraying, perhaps as a result of normal fruit drop, which takes places in fruit trees after the setting of the fruits. During 1949, 28·7 and 0·7 fruits were set, on an average, per sprayed and unsprayed inflorescence respectively, after five weeks of spraying. The number was further reduced to 4·0 and 0·2 respectively within six weeks of spraying.

← Power sprayer, fully charged with spray material, being taken to the place of action. (Plate 33).

Efficacy of power spraying

In 1948, power spraying was tried in the month of May, when the insect was met with in the adult stage. The population of the adults before spraying and 24 hours and 48 hours after spraying was determined and is given in Table I.

TABLE I

Efficacy of power spraying with 0·15 per cent DDT against adults

Number of adults per sq. in. before spraying	Calculated population on 6 ft. of main trunk	Number of adults per sq. in. 24 hours after spraying	Calculated number of adults on 6 ft. main trunk 24 hours after spraying	Number of adults per sq. in. 48 hours after spraying	Calculated population of adults on 6 ft. main trunk 48 hours after spraying
3·19	15,158	0·42	1,955	0·12	570

In 1949, large scale power spraying trials with 0·15 per cent DDT spray were conducted during March against the nymphs. The population of the nymphs on the treated and control trees was recorded before and after spraying and is given in Table II.

TABLE II

Efficacy of power spraying with 0·15 per cent DDT against nymphs

Treatment	Average population of nymphs per one inch of inflorescence (average of 60 shoots)				
	Initial population on	Population after spraying on			
	15-3-49	16-3-49	23-3-49	30-3-49	7-4-49
Sprayed trees ..	9·7	0·7	0·2	0·2	0·1
Unsprayed trees ..	10·5	10·6	18·9	21·7	7·5

It will be observed from the above that spraying of seedling mango trees of about 40 ft. to 50 ft. height, was so thorough that the pest was effectively controlled both in the adult and the nymphal stages even with a single 0·15 per cent DDT spray. An orchard of 300 seedling mango trees which used to bring an annual income of about Rs. 400 only, brought an increased income of Rs. 5,300 that year (1949), after it was sprayed with power sprayer against mango hopper. Similarly, a mango orchardist who got his mango garden (285 trees) sprayed during 1949, got an income of Rs. 2,950 that year as against Rs. 100 only which he got during 1948. The example, cited above, clearly demonstrates the usefulness of power spraying with DDT against mango hopper in seedling mango orchards which predominate in the Punjab mango-growing tracts.

Economics of power spraying with 0·15 per cent DDT

Besides unskilled labour, one mechanic is required to work the engine and supervise the spraying operation. As already given, one power sprayer can spray about 300 seedling mango trees in a day of six working hours. The cost of spraying has been worked out as under :

	Rs.	as.
Bullock labour : One pair at Rs. 10 per day	10	0
Manual labour : Four men at Rs. 1-12 per man per day ..	7	0
One mechanic at Rs. 3 per day	3	0
Cost of petrol, kerosene oil, etc. : 1 gallon petrol @ Rs. 2-12 per gallon	2	12
Kerosene oil 3 gallons per day at Rs. 1-14 per gallon ..	5	10
Lubricating oil ¼ gallon per day @ Rs. 9 per gallon ..	2	4
Cost of insecticide : Cost of (54 lb.) Geigy 550 at Rs. 3 per pound.. (1,800 gallons of 0·15 per cent DDT)	162	0
Total ..	192	10

Number of mango trees sprayed per day 300
Cost per tree .. Rs. 0-10-3

It will be seen from the above that insecticide forms the major item of expenditure and if we split up the various items, the cost of working the sprayer alone comes to Rs. 0-1-7 per tree and that of insecticide alone comes to Rs. 0-8-8. In case the bullock labour is

Spraying guns adjusted to spray the top portion of mango trees. (Plate 34). →

provided by the orchardists and mechanic is supplied free of cost by the Department of Agriculture, along with the sprayer, the cost will be reduced from Rs. 0-1-7 to pies 10 per tree plus the cost of the insecticide.

Difficulties encountered

The following difficulties were encountered in the working of these sprayer :

(i) The power sprayer, as manufactured, is meant to be drawn by a motor vehicle, or a tractor. The beam in front, therefore, is too small for hitching a pair of bullocks to it. Because of this, the front tyres of the sprayers strike hard and injure the hind legs of the bullocks, when the bullocks stop or slow down. In case, it is to be drawn by the bullocks, the beam shall have to be increased in length.

← Spraying guns adjusted to spray the lower branches and stems of mango trees. (Plate 35).

(ii) There is at present no provision by which the engine can suck water into the tanks from the well. About one-third time is, therefore, spent in charging the tank with water by manual labour. The efficiency will increase if Bean tank refillers, which will suck water from ponds, ditches, streams and wells, are fitted to the machine.

(iii) As already discussed, the engine is started with petrol and then it is put on kerosene oil. When the engine is stopped from working, great difficulty is experienced in starting the engine, if kerosene oil is allowed to remain in the carburettor, as it does not ignite soon. So when stopping the engine from working, first cut off the kerosene oil supply from the tank and then allow the kerosene oil in the carburettor to get burnt up and let the engine stop automatically.

INSTITUTE OF FRUIT TECHNOLOGY

IT has been decided to merge the Institute of Fruit Technology with the Central Food Technological Institute at Mysore.

In view of the changed conditions after the partition and the increasing need for economy, it has not been possible to set up the Institute of Fruit Technology on a permanent basis at Delhi as had been originally planned. Other difficulties have been the lack of a suitable site and proper accommodation.

The staff transferred from Delhi to the Mysore Institute will continue to

(a) impart higher training both in theory and practice in fruit and vegetable preservation to students from all over India,

(b) carry out higher type of research on the manufacture and standardization of various fruit and vegetable products necessary for the Fruit Preservation Industry,

(c) offer technical advice and guidance to the Fruit Preservation Industry, and

(d) coordinate research work throughout India. (*P.I.B.*)

What the Scientists are doing

CONSERVATION OF NUTRIENTS IN RICE

RICE is one of the three main staple cereals of the world and quantitatively the most important, as it forms the food of more than half the human race. But it does not contain sufficient amount of nutrients needed for health. The results of the chemical analysis at the Nutritional Research Laboratories, Coonoor, reproduced below clearly show that rice is remarkably poorer than wheat, *jowar*, or *bajra* in all the nutrients, viz. proteins, fat, minerals and vitamins.

	Protein	*Fat*	*Minerals*	*Calcium*	*Phosphorus*	*Iron*	*Vitamin A*	*Vitamin B*
Rice (raw milled)	6·9	0·4	0·5	0·01	0·11	1·0	0	20
Wheat (whole)..	11·8	1·5	1·5	0·05	0·32	5·3	108	180
Jowar ..	10·4	1·9	1·8	0·03	0·28	6·2	136	115
Bajra ..	11·6	5·0	2·7	0·05	0·35	8·8	220	110

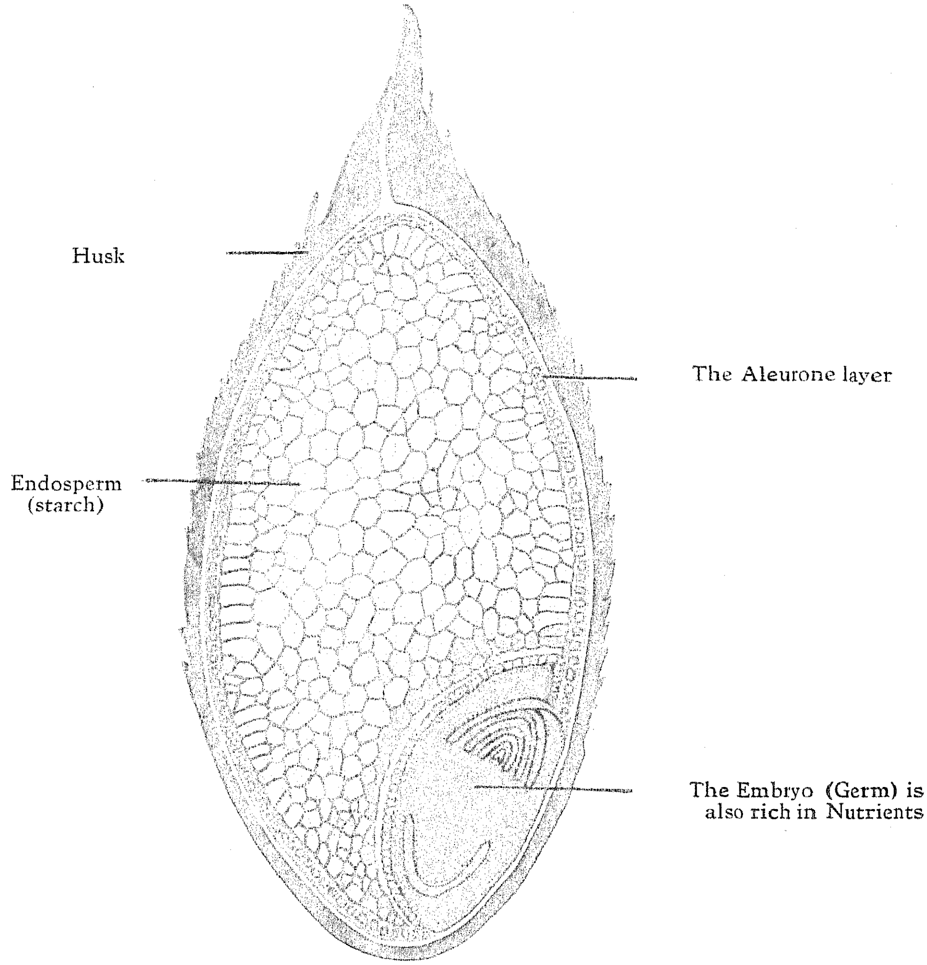
The husk has to be removed from the paddy grain before rice could be obtained. This process consists of two stages, (i) hulling and (ii) polishing, both of which deprive rice of its nutrient elements. It is estimated that about 15 per cent of the proteins and 75 per cent of the thiamin, i.e. (proteins) may be removed by milling. The accompanying diagram illustrates the various parts of paddy grain. The nutrient substances are contained in (1) the embryo or the germ and (2) the aleurone layer. Coarse and coloured rices have a thicker bran layer where all the nutrients are accumulated. This layer has been found to be thin in the case of long fine white rices. In the production of new varieties of rices possessing high nutritive content, the breeder will have to select types with a thicker bran layer.

The germ breaks off in hulling and is thus entirely lost. A large portion of the aleurone layer is also removed in the ordinary methods of polishing in vogue. To avoid this loss, 'undermilling' is resorted to, but it has the disadvantage that undermilled rice, in addition to not being acceptable to the consumer, has also poor storage quality. The conservation of nutrients in the rice grain is thus a matter of vital importance for the health of the rice-eating population.

This could be achieved through the introduction of improved methods of hulling, polishing and other processing of paddy. It is reported that the 'Wemanco Ideal Huller' is one such improved machine in which only a very small percentage of the germ breaks.

Parboiling is an ancient method of processing paddy which originated in India. It has been shown that in parboiling vitamin and other nutrients, originally concentrated in the germ and aleurone layer, diffuse towards the interior of the grain. When the peripheral layers happen to be removed during polishing the loss of vitamins and minerals is very much less than would be the case if the raw rice were milled. Parboiling also toughens the grain and reduces the percentage of breakage during milling. Milled parboiled rice is less easily attacked by weevils than milled raw rice and has, therefore, better keeping qualities.

PADDY GRAIN



Husk
The Aleurone layer
Endosperm
(starch)
The Embryo (Germ) is
also rich in Nutrients

What the Scientists are doing

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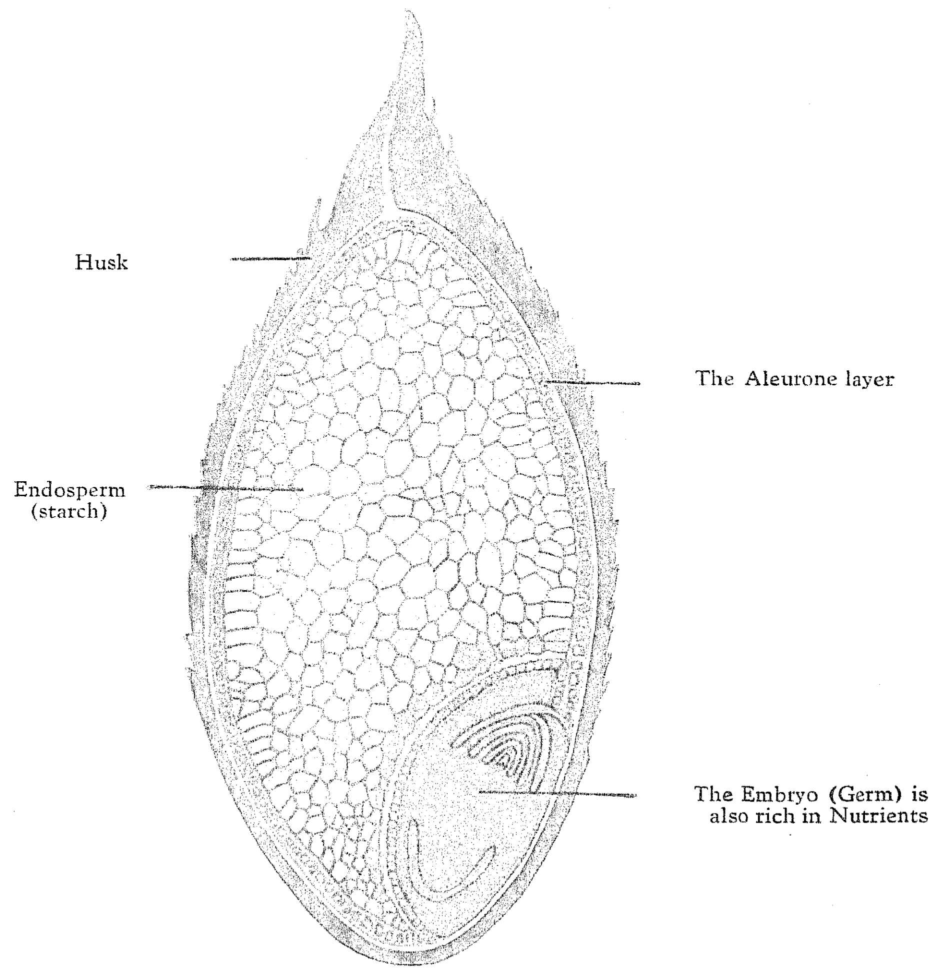
Husk
The Aleurone layer
Endosperm
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The Embryo (Germ) is
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A modern parboiling method known as 'Malek Rice Process' has recently been developed in the United States of America. It consists of four stages namely cleaning, soaking, steaming and drying. This modern rice processing method is claimed to benefit the rice processor, the miller and the consumer. Malekized rice is reported to be easier to cook, taste better, looks more attractive and easier to store than the ordinary raw or parboiled rice. It is also claimed to retain more nutrients in the grain. (R.S.).

URENA LOBATA REPLACING JUTE IN SOUTHERN RHODESIA

IT is reliably reported that the factory at Umtali in Southern Rhodesia has started producing 200 lb. grain bags at the rate of 8,000 a week, states the March issue of *Jute Bulletin* recently released by the Indian Central Jute Committee.

Completion of the factory equipment with the installation of another 50 looms is expected to raise production gradually to the rate of 20,000 bags a week in course of six months. Production of 100,000 bags weekly is the ultimate target fixed.

Progressively higher percentage of *Urena lobata* is being used with the imported fibre in the manufacture of bags and the idea is to eliminate jute imports altogether in about three years' time. The factory now employs 300 native workers to be ultimately increased to 1,000—(*I.C.J.C.*)

You ask We answer

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in States. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

KEY VILLAGE PLAN

Q. What is a 'Key Village Plan' I have heard so much about in recent months ?

A. The Key Village Plan is primarily a plan for replacing the present system of indiscriminate and haphazard bull distribution by a system which will ensure that :

(a) the progeny of superior bulls is not served by scrubs ;

(b) all progeny of superior bulls will be provided with equally good or better bulls for unbroken continuity of controlled breeding for successive generations till the population, originally started with, is fully graded up.

The absence of these two conditions renders bull distribution work ineffective, because at present there is only one bull where 250 are required, and, when they are distributed indiscriminately their progeny is often served by scrubs, nullifying in the second generation the improvement obtained in the first.

Thus, complete coordination of castration and bull distribution, concentration of available breeding bulls in selected compact areas (or key villages) and the continued supply of similar bulls for a period of years till the whole population is improved, constitute the essence of the key village scheme. Under this scheme, bulls of known parentage and transmitting ability, which are produced on Government farms or elsewhere, are multiplied in the key villages and then distributed in the country at large. Any improvement produced on the farms is, therefore, multiplied in the key villages whence they radiate into the country at large.

The plan is to start and develop the villages gradually, in order to make them work ultimately in exactly the same way as cattle breeding farms. When that stage is reached, the key villages can be employed for investigating the numerous problems on animal husbandry like feeding, disease control, different aspects of breeding and rearing, etc. which are now investigated on farms. It is well-known that the conditions on the farms are different from those in the villages and, therefore, the applicability of results obtained in the former to conditions in the latter should be fully tested before those are introduced in the country as a whole. The key villages will thus serve as a bridge between the research worker and the cultivator.

CONTROL OF RINDERPEST IN MYSORE*

SPECIAL attention is being paid by the Animal Husbandry Department to the control of contagious diseases of livestock in general and that of rinderpest in particular in the State. By a system of very efficient reporting and with the help of biologicals that are manufactured by the State Serum Institute attached to the Department, immediate measures are being taken to control epidemics as speedily as possible with a view to minimize losses therefrom in the affected villages and to check their spread into surrounding ones.

The last wave of rinderpest in the State was during the years 1942 to 1944, when as many as 8,000 outbreaks were handled and more than 20 lakhs of cattle were protected against the disease. These outbreaks accounted for, according to the available figures, more than a lakh of animals, which succumbed to the disease and in all probability the actual number of deaths is considerably more than this figure.

A wave of rinderpest during the current year is, therefore, imminent in view of the large number of susceptible animals that are now available in the form of the progeny of these animals that have survived the previous outbreaks; and all possible precautions are being taken by this Department to attend to these outbreaks as and when they are reported and to check their spread to the surrounding villages.

In this connection an account of the system of reporting of outbreaks of rinderpest in the State as also the organization for controlling the disease may be of interest to others dealing with similar work.

On the appearance of any outbreak of any contagious disease, more especially rinderpest, in any village, the concerned *patel* reports the same to the Area Veterinary Officer (Veterinary Inspector) and submits copies of the same to the Assistant Director of the Department incharge of the district as also to the *amildar* (*tahsildar*) in charge of the taluk. On receipt of either this report or even oral report from the *patel* or any person connected with the village, the Veterinary Inspector registers the outbreak in his office in a special register and sends copies thereof to the *amildar*, Assistant Director and the Director indicating that he has taken cognizance of the outbreak and that he would be taking further necessary action in the matter. After sending this report, the Veterinary Inspector visits the village immediately (not later than 24 hours after the receipt of the report of outbreak), investigates into the nature of the disease and if it is rinderpest, arranges for the inoculations immediately in that village and indents for the required quantities of biologicals directly from the Serum Institute telegraphically. If the disease is wrongly reported as rinderpest, he notifies the nature of the disease to the higher officers of the Department and the *amildar* and takes such action as may be necessary with regard to the control of that particular disease. If it is rinderpest, he submits his daily report to the Assistant Director and the Director of the Department. The Assistant Director on receipt of the information that the disease in question is rinderpest, mobilizes as many veterinary inspectors and stockmen as he may conveniently draft from his area, indents for the necessary biologicals from the Serum Institute and takes up preventive inoculations in the surrounding villages with a view to create immune belts round about villages as speedily as possible. At the same time he also addresses the District Magistrate requesting him to enforce the ban on movement of cattle from the infected village, to stop the local weekly markets or

*Contributed by the Director of Animal Husbandry, Mysore State.

shandies where cattle from the infected village are likely to gather and for enforcing compulsory inoculations of all cattle in the infected village under provision of the Contagious Diseases of Animals Act of 1949.

The State was practically free from rinderpest since 1945, but outbreaks are now being registered during the current year in the three districts of Chikmagalur, Chitaldrug and Hassan. The infection is traced to a batch of buffaloes that were being marched through the State from Hindupur to the Subrahmanya Cattle Fair in Mangalore District of Madras, infection having started in those villages of the State where migrating animals have halted for the night. Inoculations have been undertaken in all infected villages promptly on 13,596 cattle and preventive inoculations have been conducted in as many as 41 villages surrounding the infected ones. The disease appears to be now under control.

During the recent visit to the State, Sardar Datar Singh, Vice-Chairman, Indian Council of Agricultural Research and the Additional Secretary to the Government of India, Ministry for Agriculture, was pleased to inspect the work done in Chikmagalur district with regard to single outbreak that was reported in Mugalvally village. The staff of this district have protected 819 animals of the infected village and have conducted preventive inoculations on 3,066 animals in six villages which are within a radius of two miles from the infected village. The work of extending the immune belt to a radius beyond two miles is under progress and it is expected that by this intensive and systematic work, the danger of rinderpest spreading into the rest of the State will be averted.

Abstract of work done in connection with rinderpest in Chitaldrug, Hassan and Chickmagalur districts

District	Taluk	Village	Cattle census	When affected	Attacks	Deaths	Inoculations	Last date of attack	Last date of death	Work done in neighbouring villages	
										Number of villages visited	Number of animals inoculated as a preventive measure
Chitaldrug	Holalkere	Bommanakatte	500	29–10–49	29	10	451	25–11–49	12–11–49	10	2,673
	,,	Gunderikaval	350	11–11–49	6	4	344	9–11–49	25–11–49		
	Hosadurga	Katala	400	13–11–49	12	4	380	14–11–49	9–11–49		
Hassan	Arkalgud	Aldahalli	400	25–11–49	43	16	386	8–12–49	3–12–49	8	1,717
	,,	Tagare	700	25–11–49	15	8	679	2–12–49	9–12–49		
	,,	Hullangala	500	2–12–49	5	2		12–12–49	7–12–49		
	Alur	Thippanahalli	250	12–11–49	8	3	230	27–11–49	30–11–49	7	1,302
	Saklespur	Kaltora	200	10–11–49	44	20	123	11–12–49	14–12–49	10	1,281
	,,	Kummathahalli	200	15–11–49	38	17	145	12–12–49	16–12–49		
Chickmagalur	Chickmagalur	Mugulvally	850	15–11–49	25	10	819	7–12–49	9–12–49	6	3,066
		Total	4,350		225	94	3,557			41	10,039

Note.—Altogether three Assistant Directors, 10 Veterinary Inspectors and two stockmen were engaged in the control of the above outbreaks.

Across the Borders

IMPROVING YIELD OF RICE CROPS

By CLIVE RATTIGAN

NO food crop produced for and by man is of quite the same importance as rice, the staple food of more than half the world's total population and on which millions in Asia practically wholly subsist.

World War II caused much destruction of rice crops in Asia, the abandonment of cultivated areas and the failure to maintain irrigation systems. It produced, too, considerable political unrest which had the effect of further interference with rice growing. These things help to account for the post-war decline in Asian rice production.

The full gravity of the rice situation is, however, due to the fact that for decades past rice production has failed to keep pace with the growth of the rice-eating population. As the Food and Agriculture Organization of the United Nations stated in a recent report : 'In the period between the two world wars production of rice in South and East Asia increased by less than 10 per cent, whereas the population, according to available evidence, increased by more than 20 per cent. The rate of increase of the basically rice-eating population of the world approximates ten millions each year'.

Annual loss

Among the measures recommended, by the Rice Conference at Baguio in 1948 to meet the deficiencies of rice production, was a campaign to reduce preventable losses of rice through insect and rodent infestation, faulty methods of storing, wasteful milling and indifferent processes of household preparation. Figures placed before the Conference indicated that more than 10,000,000 metric tons of rice were annually lost through these causes.

Obviously, there is scope for improvement here, but it is to be feared that centuries-old habits are not easily susceptible to reform and that the only part of these suggestions likely to be found generally practicable will be the control of insect infestation by the use of insecticides.

More promising measures are some extension of the areas sown and efforts to improve crop yield through seed selection, better drainge and fertilization.

Mechanization, of course—as it has been so successfully employed in the United States and Australia, and as it is being experimented with in British Guiana and Malaya at present—is hardly suitable to Asia generally with its abundance of labour, small holdings and its lack of capital.

Use of fertilizers

It is in the use of chemical fertilizers to improve the yield of rice crops that perhaps the best hope of solving Asia's rice problem lies.

Throughout extensive areas of Asia scarcely any chemical fertilizer has ever been used for the cultivation of rice, even in the principal rice-exporting regions such as Burma, Thailand (Siam) and Indo-China. It has only been the ploughing-in of the stubble and of the weeds that grow while the land is fallow that has restored a certain degree of fertility to the soil and though the land continues to yield crops, the yields are not what they might be if proper methods of fertilization were applied.

Hitherto, chemical fertilization for rice crops has been a chancy business ; it has had its successes and its apparently inexplicable failures. Now, however, science has stepped in to resolve difficulties and open the way to a clearer understanding of the right types of fertilizers to employ in particular cases.

Studying marsh conditions in Cumberland,

Professor W. H. Pearsall of University College, London, found it possible by electrical processes definitely to ascertain in water-logged soil the precise limits of the oxygen containing top layer and of the non-oxygen containing layer underneath. This is a highly important discovery because the effectiveness of different chemical fertilizers is dependent on the presence or absence of oxygen. It has been extremely difficult hitherto to discover at just what levels in a wet soil the oxygen-containing and non-oxygen-containing layers are in varying conditions of weather, water and of the soil itself.

Scientific basis provided

Briefly, to quote from Sir John Russell's presidential address to the British Association, Professor Pearsall has given the world 'for the first time a scientific basis to the manuring of the rice crop ; another example of the far-reaching results that may come from a purely academic enquiry well carried out.'

Japan, which has produced relatively big rice yields in the past through the use of chemical fertilizers, has been very quick, as Sir John Russell also mentioned in his address, to give practical application to Professor Pearsall's discovery. (*B.I.S.*)

PLANT PROTECTION

PUNJAB went ahead with its schemes of protecting crops against damages of wild animals. A large number of monkeys were killed in three districts of the State and an area of nearly 17 lakhs of acres in four districts was cleared of rats. In West Bengal, 100 acres of potato fields were treated with insecticides by the Government plant protection parties during the period ended February 15, 1950.—*Food Bulletin.*

CULTIVATION OF 'RAMIE' PLANT

By B. C. KUNDU

RAMIE fibre is obtained from *Boehmeria nivea*, a perennial herbaceous or shrubby plant belonging to the family *Urticaceae*. The slender stalks of the plant reach a height of 3 ft. to 7 ft. and bear heart-shaped leaves that are green above and whitish beneath. A variety of Ramie, *Boehmeria nivea* var *tenacissima* is sometimes differentiated as *rhea*. The plant resembles Ramie except that the leaves are green on both sides. The fibres from both types are identical and for commercial purpose. The two types are sometimes differentiated as 'white Ramie and green Ramie.'

Ramie is a very strong and durable fibre and is being used for centuries in India, Malaya, China and Egypt. In India it is cultivated in Assam, Eastern and Northern Bengal. It is employed by the growers in Assam and Bengal in the manufacture of fishing lines, nets and for all purposes where strength is an important factor. It has a lustre equal to that of silk, which is not destroyed by washing. It can be regarded as the best textile fibre.

The Ramie plant is exceedingly hardy and thrives in almost any description of soil. But preference is given to a rich light sandy loam. The sub-soil should be good as the roots penetrate 12 to 14 in. deep in search of nutrition. High lands which are well-drained, that is, where water does not stand, are suitable for the cultivation. The plants prefer a tropical climate with a moist atmosphere and fairly good rainfall. It would succeed in almost any part of the tropical plains of India.

The plants are propagated from root-cuttings and sometimes from stem-cuttings of mature plants or from seeds. There are two seasons for the plantation of Ramie, viz. April and May, i.e. before the commencement of the rainy season ; and secondly, September and October that is, at the end of the rainy season.

Plants are cut down before they run to flower and before they bring forth branches. Two to four cuttings (sometimes five) are obtained in a year. Fibres from the second cutting are considered as best and those from the first as worst.

Separation of fibre

Ramie fibre cannot be extracted from the stems of the plant by the ordinary process of retting, as is done in the case of jute, hemp, etc. The separation of the fibre is a laborious process and many difficulties are encountered during the extraction and cleaning of the fibres because of the gummy matter which adheres to the fibre. There are different methods of separation in different areas. In China and India, where this fibre has long been employed for the weaving of the finest and most beautiful fabrics, the decortication of the fibre is carried out by hand. The stems are at first soaked in water and then the bark is scraped off. About 10 lb. of cleaned Ramie fibre can be produced in a day by this process. In China, Borneo and Sumatra a sort of water retting is also undertaken. In Java the growers after dividing the stalks into halves lengthwise, remove the bark ; from this bark they separate the epidermis and the adhesive portions with a knife until the fibre begins to appear. The fibre then obtained is washed several times in water and then dried. But this manipulation is not sufficient to get rid of the glutinous matter which adheres to the fibres entirely.

In Upper Assam the grower separates the bark with fibre from the stalk in two strands by operating the stalk with a peculiar

B. C. KUNDU is the Director of Indian Central Jute Committee, Calcutta.

movement of the forefinger and the thumb. These strands are heavily coated with gum and require further laborious treatment before they can be used. They are later on cleaned by means of a small knife.

The freshly harvested stems may yield from 2 per cent to 4 per cent crude fibre which has commonly been designated as 'China grass'. The fibre is purified by the removal of gums and encrustants at spinning mills before spinning.

By the above process of separation all the gummy substances are not thoroughly removed. The gum left on the fibres is allowed to dry on and intensifies the difficulty of its removal. It is largely owing to this and as the fibre was not available in large and standardized quantities the Ramie industry has not made much progress. The Ramie fibre having been made known in Europe at the beginning of the 19th Century, the attention of experts was immediately turned to the question of improvement in the extraction and preparation of fibre. Certain firms in England tried to develop decorticating machineries; but none of them proved very satisfactory.

In 1869, to encourage the invention of a suitable decorticating machinery an announcement was made by the Government of India in June, 1870, that a public competition would be held and a prize of £5,000 would be given for the best machinery. Thirty-two competitors entered, but only one appeared in India. The machinery was not found suitable. In 1873, fresh trials were arranged to take place in England and 200 applicants responded. The trial did not however prove a success. In 1877, the Government of India renewed the offer of reward. Ten out of the 24 competitors arrived at Saharanpur where the competition was to take place. But none of the machineries were found quite suitable.

The Germans evolved a decorticating machinery, but not much is known about it. A certain firm in America has recently manufactured a decorticating machine, the 'Morgan Decorticator', which is being claimed to have solved the problem of decortication in a satisfactory manner. It has been said that the 'Morgan Decorticator' eliminates practically all waste of fibre, and the fibre produced is undamaged, thereby enabling the textile manufacturer to pay a higher price to the producer for a uniformly superior fibre.

Besides the Morgan decorticator, other types of decorticators have been evolved both in America and Australia. Decorticators are of two kinds, those that merely strip the bark into ribbon from the stem and those that in addition attempt to remove the outer layer from the strips of fibre.

The final degumming process of the fibre is carried out in the mills, where the Ramie is later spun into yarns. Degumming immediately after decortication will yield better quality of fibre. Researches have been conducted with a view to discovering a suitable and efficient process of degumming. Various industrial concerns in Europe and America have worked out their own degumming processes, which have been kept as trade secret by them, but the main processes are known in general.

Ramie is not so largely cultivated in this country that we may give reliable information about the output. In Bengal the yield is estimated to be between 500 lb. and 600 lb. per acre. In China where it is more carefully cultivated it yields about 1,000 lb. per acre. It is understood that the yield is much more in the recently developed plantation in Florida (U.S.A.). It is possible to increase the yield and improve the quality of Indian Ramie fibre, but for all these extensive research work is essential.

The Jute Agricultural Research Institute which has been entrusted by the Government of India to take up research work on all fibres considered to be substitutes of jute, has already taken up, though in a modest way, botanical and agronomical research work on Ramie.

During pre-war times, Ramie was mostly exported to Japan, England, France and Germany and also to the U.S.A. Actual export figures from India are not available.

Ramie is grown in China, Egypt, India, Dutch East Indies, Philippines, Manila and Japan; and commercial plantings have been made in Algeria, Belgian Congo, British Africa, Australia, Central and South America, Mexico and the U.S.A., principally in Florida and Louisiana.

Ramie fibre is the strongest vegetable fibre known. It is durable, absorbent, lustrous

and wears longer than other vegetable fibres. The tensile strength is four times that of flax ; eight times that of cotton, three times that of hemp and almost eight times that of silk.

Ramie fibre blends perfectly with cotton and flax and also with wool, rayon, silk and hemp and other fibres which have greater elasticity. It gives added value to such yarns or fabrics.

Ramie fibre is used in Northern Bengal for fishing nets and lines. In China and Japan cloths of superior and fine qualities are woven with this fibre. In Europe it is used for underwear, portieres, upholstery, thread and paper.

Ramie may be put to a multitude of industrial uses. It may be used for parachutes and aeroplane fabric, for filter cloth, for gas filters, gas mantles, electric insulation, canvas, sails, etc. During the second world war Ramie fibre was used in England only for a braided rope for merchandise parachutes ; in the U.S.A. nylon or rayon were used instead for this purpose.

Production in other countries

Ramie industry has flourished in Europe and America with the supplies of dried ribbons (china grass) mainly from India and China. Recently many countries like the U.S.A., Australia, some of the American republics have also taken up largescale cultivation of Ramie. In a report published in the *Cordage World* (Vol. 27, No. 2, page 18, 1946) it is noted that Ramie cultivation has been extended considerably in the Philippines and as a result export of Ramie fibre from the Philippines has increased nearly $2\frac{1}{2}$ times. The fibres in that country are successfully decorticated by a simple type of machine decorticator. In view of the increasing demand for Ramie in various countries including the United States and Argentine, Ramie cultivation in Brazil has been increased recently.

This very valuable fibre has been sadly neglected in India where it is an indigenous crop. Long ago the Government of India recognized the wonderful properties of Ramie and its immense possibilities, but nothing further has been done by them.

There are vast possibilities of developing Ramie as a textile fibre, provided it can be grown and produced cheaply. Mr. Alfred Wigglesworth, Chairman of the Fibre Sub-Committee of the Imperial Institute, London, once expressed before the Royal Society of Arts, London, that if a machine could be evolved to extract the fibres economically from Ramie stalks, India would be in a paramount position for its production owing to the suitable condition of soil, climate and labour. In India Ramie plantation can be developed very easily in many parts particularly in Assam and Northern Bengal (Jalpaiguri) and West Dinajpur and North Bihar. The only problem was to decorticate by machineries and degum the fibres efficiently. Different types of decorticating machines have now been evolved and the process of degumming is no longer a trade secret.

The development of Ramie industry which has a great future will increase our national wealth to a considerable extent. It is high time that Government of India should take up this matter seriously and encourage the cultivation of Ramie in different parts of India and set up one or more full-fledged industries in the country.—Reproduced from *The Hindu*, 26, January, 1950.

Book Reviews

COOPERATIVE FARMING IN MAHARASHTRA

By W. B. Donde (Published by the Provincial Cooperative Institute, Bombay, pp. 44, Rs. 1–8).

THIS is an extremely useful and instructive pamphlet published by the Provincial Cooperative Institute, Bombay. It contains the results of first-hand investigation of eight cooperative farming societies in Maharashtra. Unfortunately, all the eight societies have been recently organized and, as such, Mr. Donde is unable to express any definite opinion about the possibilities of permanent success of cooperative farming in this country. His general observations on the facts which should assist in ultimately achieving success in cooperative farming are, however, useful. It is rightly observed that the possibilities of success are greater when such societies are organized amongst cultivators having uneconomic holdings, but enjoying equal ecomonic position. For obvious reasons, it would not be possible to get farmers with equal economic status, though it would be certainly desirable to avoid combination of farmers with widely varying individual economic status. In peasant farming countries, labour is by far the most important item in the farming costs and, as such, successful cooperative farming would also depend very largely on the extent of development of cooperation of farmers who put in their labour in the cooperative farm. Homogeneity in the matter of social status, caste and food habits are, therefore, more important in the successful organization of a cooperative farm than mere economic position of individual members of the society.

Mr. Donde has made his pamphlet still more useful by giving a brief account of the different forms of cooperative farming as developed in other parts of India and other countries and by attaching a short note on the collective farming in the USSR. (T.G.S.).

'खेती व पशुपालन गणित' KHETI WA PASHUPALAN GANIT (HINDI)*

By Chater Sain Jain (Published by the author at Pusa College, New Delhi, pp. 256, Rs. 4).

THE book under review is divided into 10 chapters and a summary of all the chapters containing important points of each chapter has been given in the very beginning of the book. The book is the most important one for the farmers, manager incharge of the farms and landlords, etc. It contains all that a farmer should know to carry on his work smoothly and to the point.

The first chapter deals with the necessity of keeping accounts while the second with the making of inventory. The third chapter describes the methods of assessing the value of various articles. The fourth chapter deals with the necessity of keeping note book, cash book and *roznamcha* register and their maintenance in order to check the difference in production and that of income and expenditure each year when compared wih the previous years. The fifth chapter contains the methods of keeping and maintaining a cash book with analysis column. The sixth chapter deals with the methods of closing accounts of a financial year. Some examples have been given to prepare loss and profit, and income and expenditure statements after the close of a financial year. The seventh chapter gives the list of various registers for keeping record of various articles along with a sample form of each register. The eighth chapter describes the rules for dealing with the banks. The ninth chapter deals with the methods of exchange and promissory notes, etc. with solved sums.

The last is the most important chapter dealing with the cost of production, application of doses of manures and fertilizers to

*An English edition of the book is available under the title *Farm Book-keeping* (Published by the author, 1950, pp. 420, Rs. 5).

certain crops and their yield with the use of different doses, estimating expenditure of all kinds, i.e. irrigation charges, miscellaneous expenditure, weighing charges, guarding charges and manure expenditure, etc.

It may also be pointed out that the book contains one exercise of questions like History and Geography books after every two chapters, i.e. five exercises in all.

Several books have been written in English but to the best of my knowledge this is the only one written in Hindi. Hindi being the national language of free India, the book is bound to be very useful for progressive farmers and is, therefore, highly commended. (K.S.).

REPORT OF THE AGRARIAN PROBLEMS ENQUIRY COMMITTEE, COCHIN

[Printed by the Superintendent, Cochin Government Press, Ernakulam, 1949, pp. 423, price not mentioned].

COCHIN and Travancore are the two regions in India with Bengal as the third where the population presses heavily with a density of 953, 792 and 779 respectively (1941 census) per square mile. This is reflected in a low *per capita* availability which in Cochin is 0·67 acre on the basis of entire land space, 0·36 acre on the basis of occupiable area, 0·29 acre on the basis of cultivated area and only 0·19 acre on the basis of food crop area. The report (p. 99) has, however, given the density at 2,176 which is evidently due to some mistake. The average size of the holding (p. 132) is below one acre or at the most $1\frac{1}{2}$ acres. The tendency is for further fragmentation. The average family is 'larger than anywhere else in India' and may have lost their holdings during the depression on account of debt (p. 135). The condition of agricultural population is naturally very serious. The agricultural labourer has no work for 120 to 200 days in a year. Rice, though main food, is in huge deficit which has made tapioca the prevailing supplement but 'it is not only costly but needs to be balanced by fish whose price the common-man in Cochin cannot afford at all'. The cost of living index of food has gone up to 368·28 per cent. 'The prevailing rents are disproportionately high' (Interim report, p. 1) and 'some immediate relief is necessary for the cultivating tenants.'

An intensive enquiry in such a state of affairs was overdue and thus, the Enquiry Committee was not instituted too soon. The Committee was constituted with Sri K. G. Sivaswami as Chairman and nine members, subsequently increased to ten.

The report is divided into an 'interim report' (Part I), followed by a detailed report (Part II and the rest). In all, it covers 423 pages and is replete with much useful information.

The report has used a good many local terms for which a glossary has been provided, but in some vital matters the meaning has been left out. For instance, it is stated in the first page (last line) that 'expenses range between 4 and 7 *paras* per *para*'. We miss the word *para* in the glossary. If, however, we go through each and every word there, we come across *mudra para* and *pattapara*, one meaning standard measurement for grains, etc. and the other of paddy given as rent. It is, unfortunately, very common in many of our Indian publications that the matter is not presented in such a way that it may be equally understandable to local as well as other readers. The book is without an index, the incorporation of which would better serve the purpose for which this report has been prepared.

The book bears evidence of assiduous labour and contains much revealing information some of which is noted below :

The evil of absentee landlordism and land concentration has reached its limits in Cochin. Sixty-one per cent of wet lands and 50 per cent of *parambas* (garden lands) are held by absentee landlords (p. 69 and 70).

All responsible and representative opinion.... clearly establishes the existence of rack rents (p. 4).

The overwhelming majority of producers are tenants under superior landlords who have begun to realize the stipulated rent to the last pie resulting in a large increase in suits for rent realization and evictions.

Most of the paddy owners wield great influence and are 'capable of easily thwarting

the ways of even the highly paid grain purchasing *tahsildars*' (p. 69). In page 322, it is further said that 'one of the special problems of Cochin is the great power and influence, quite out of proportion to the service they do, which big wholesale merchants command in official and unofficial circles.'

The penalties paid for illiteracy and ignorance by agricultural labour are many. The caste-leaders dominate their lives, and levy fines for infringement of social rules (p. 348).

The Committee has made many proposals including relief and reduction of rents, fixation of fair rents, etc. At the same time it 'does not want, as far as possible, to improve the condition of the poor tenants and at the same time make the superior holders poorer' (p. 8).

There is no doubt that many of the recommendations of the Committee compel attention and should be examined by competent authorities. (I.B.).

SUNHEMP DEVELOPMENT SCHEME

A FIVE-YEAR scheme of improvement of sunhemp in Uttar Pradesh conducted by the Indian Council of Agricultural Research has led to a larger production of better fibre. The Soram Tehsil of Allahabad produced sunhemp which had about 75 per cent of sticks. An area comprising 20 villages was selected and the programme of work included distribution of selected seed, organization of cooperative societies, introduction of better retting methods and the training of cultivators in adopting methods of improved netting of the fibres and in preparing clean hemp by eliminating the 'lakharia' fibre.

The five years' work has led to the introduction of improved and selected seeds in about 50 per cent of the area under sunhemp, and it has been estimated that as a result the income of the cultivators has risen by about Rs. 30 to 35 per *bigha*. To a very limited extent, the 'lakharia' quality has also been replaced by clean fibre.—(*P.I.B.*)

News and Views

INDIAN STANDARD ON WOOL FOR EXPORT

BY far the most urgent and important problem that confronts the Indian wool-exporting industry today is the variability and, more or less, the uncontrolled quality of wool that is being sent out of the country. The adverse effect of such a procedure on the reputation and on the economic returns to the industry is fairly evident.

An effective remedy that would help the industry to grow on sound lines is to standardize the various grades of exportable wool and to ensure that the exported product conforms to those standards. The importer abroad, being thus assured of uniform quality of wool in the respective grades, can confidently trade with the country, and will perhaps be ready to pay a premium for such assurance.

With these objects in view the Textile Division Council of the Indian Standards Institution has drawn up an Indian Standard Specification for Grading of Wool for Export—IS: 10-1949. This standard applies to wool produced in India, and specifies grades both according to colour as well as quality. Specifications for packing and marking are also included. The standard is priced at eight annas.

Copies can be had from the Indian Standards Institution, Old Secretariat, Delhi. (*I.S.I.*).

NEED FOR RISE IN FARM OUTPUT IN ASIA

IF farm wages and cultivators' earnings are to be improved in Asia, a rise in the level of agricultural productivity is a 'fundamental necessity', the International Labour Office said in a report published recently at Geneva.

The report dealt mainly with the problem of raising the level of farm wages and the earnings of primary producers. It said in this connection that efforts to increase productivity would have to come 'through a general readjustment in the use of the factors of production—by changes in methods of production, an increase in capital equipment, and reallocation of resources.'

To achieve better utilization of the available land area and thus attain higher levels of production, employment and remuneration, the survey said, 'programmes for the reorganization of farming should be examined.'

This examination, it urged, should take special account of 'the possibilities of cooperative and collective methods of production and the consolidation and amalgamation of holdings into more economic units.'

In a foreword, it is explained that the report's purpose is to review 'the points to be considered in a survey of agricultural wages and incomes of primary producers, with a view to wage regulation and introduction of measures to increase these incomes.'

It contains chapters dealing with the economic background, land tenure and its effects on labour, the labour market, levels of agricultural wages, payment of wages, wage regulation and means of raising the level of remuneration in agriculture, and a chapter of conclusion.

To increase agricultural production, the study declared, the level of farm techniques must be raised by the provision of facilities for general and technical education and vocational guidance. It also suggested the establishment of research and experimental farms, the provision of incentive goods and equipment, the granting to tenants of the possibility of land purchase, and the provision of better facilities for marketing, grading and storing agricultural produce.

The report pointed out that in Asia the agricultural labour supply greatly exceeds demand. A considerable part of the labour force, it said, is unemployed or at least under-employed, 'while the growth of the rural population has outdistanced the expansion of the cultivated area, with the result that there is a constant tendency towards a decrease of regular employment opportunities and a decline in earnings per individual farm worker.'

The real problem of the landless labourer at the moment, it said, 'is perhaps not so much what he is to earn, but rather whether he is to earn at all.'

An increased demand for labour at the present technical level, the survey suggested, could be encouraged by increasing the share of income of certain categories of agriculturists, especially tenants and share croppers, in order to enable them to hire labour at a reasonable wage or to acquire some land.

In view of the special conditions prevailing in Asia, the report concluded, 'some kind of State intervention is desirable' to achieve wage regulation in agriculture.

This view was advanced, it said, 'because high rural birth rates and lack of opportunities for alternative employment in rural areas tend to create a buyer's market in respect of labour, so that agricultural wage rates compare unfavourably with those in other occupations.' The report argued also that the raising of wages through regulation may compel management to relinquish inefficient and wasteful methods of production.

COVER ILLUSTRATION

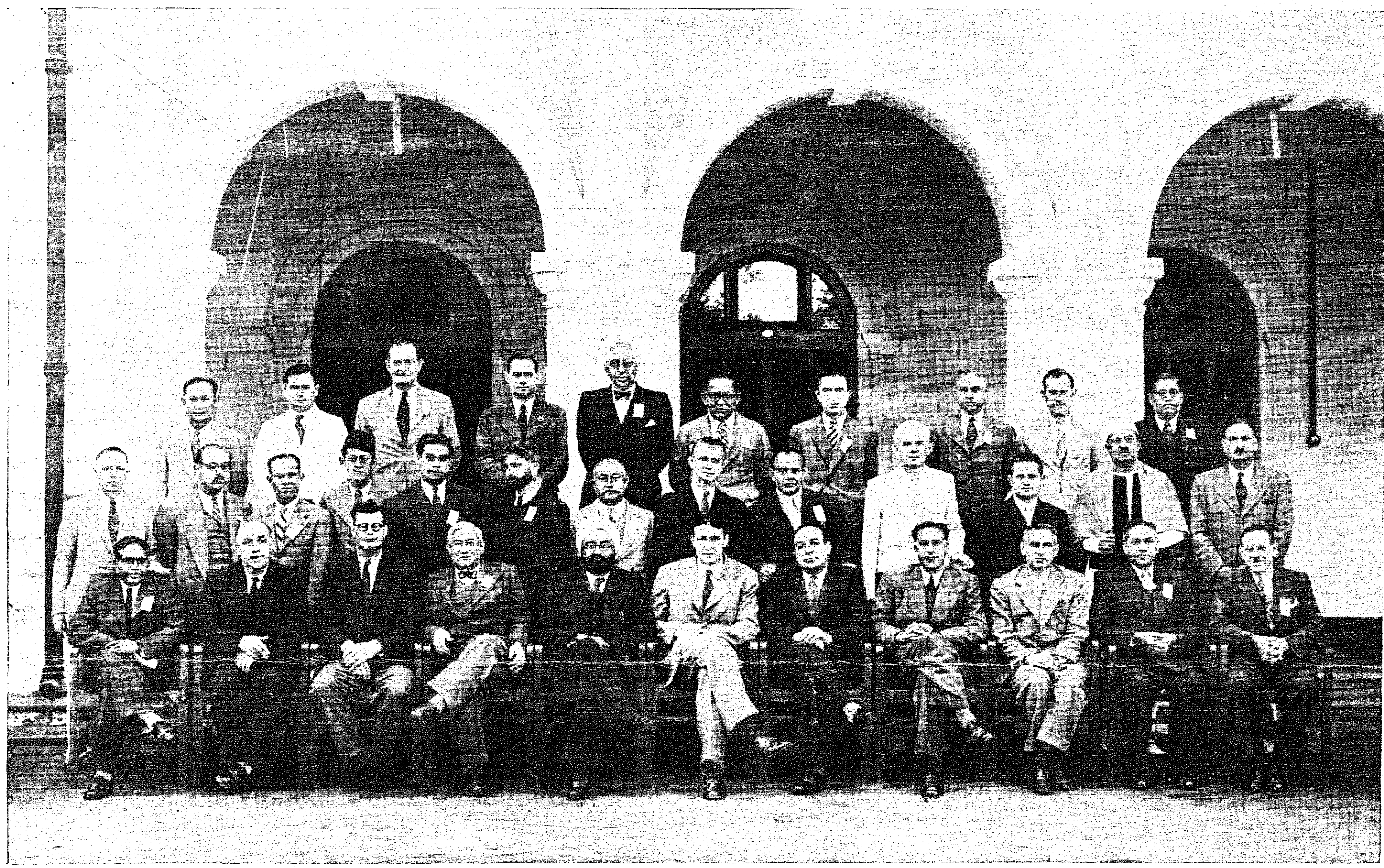
'Mudini', a champion cow with her progeny—daughter (centre) and grand-daughter (left).

—Photo by *P.I.B.*

FAO OF THE UNITED NATIONS

Meeting on Livestock Breeding under Tropical & Sub-Tropical Conditions

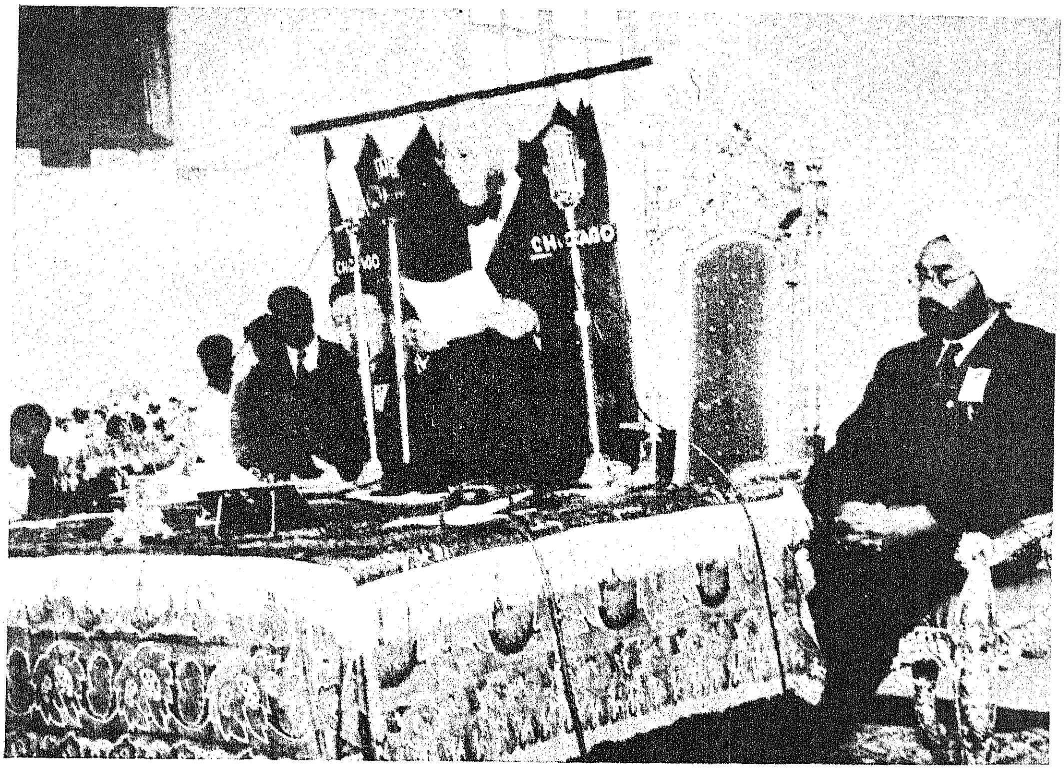
LUCKNOW (INDIA)—13-22 FEBRUARY, 1950



Sitting Left–Right:—Shri N. R. Joshi (Agriculture Divn. FAO), Mr. M. E. D. Pilet (France), Mr. D. E. Faulknert (United Kingdom), Dr P. G. Malkani (Ceylon), Sardar Datar Singh (India), Dr Ralph W. Phillips (U.S.A.), Dr A. R. Sidky (Egypt), Mr. Abdul Wahid (Pakistan), Mr. M. T. Bettini (Italy), Dr K. C. Sen (India), Dr D. H. K. Lee (U.S.A.).

1st Row Standing:—Dr H. F. Colback (Belgium), Dr I. A. Khalifa (Egypt), Mr. S. Emasiri (Thailand), Dr Sutopo (Indonesia), Mr. M. Ourandi (Iran), Mr. M. P. Receveur (France), Mr. J. Bhattacharjee (Burma), Mr. M. Feunteun (France), Dr S. Dutta (India), Dr J. P. Van Aartsen (Indonesia), Mr. A. Salerno (Italy), Raja Bajrang Bahadur Singh of Bhadri (India), Shri P. N. Nanda (India).

2nd Row Standing:—Mr. P. Siddijai (Thailand), Mr. W. Granger (Australia), Mr. A. T. Threlkend (United Kingdom), Dr Zal, R. Kothawala (India), Dr M. Idris (Indonesia), Mr. R. Restengar (Iran), Mr. W. D. E. Perera (Ceylon), Mr. T. E. Ryall (United Kingdom), Dr R. L. Kaura (India).



Above.—His Excellency Shri H. P. Modi, Governor, Uttar Pradesh, delivering his welcome address to the delegates from 13 Tropical and Sub-Tropical countries to the FAO Conference on Livestock Breeding held at Lucknow

Below.—Dr R. W. Phillips, Secretary-General of the FAO Conference on Livestock Breeding, delivering his opening address. His Excellency Shri H. P. Modi, Governor, Uttar Pradesh, and Sardar Datar Singh are also seen in the picture

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INDIAN FARMING

MAY, 1950

Vol. XI No. 5

LIVESTOCK BREEDING*

I AM deeply grateful for the rare honour and privilege which scientists from 14 countries of the world haveco nferred upon me by electing me to preside over this International Conference on a subject of absorbing interest to me. I am interested in cattle breeding not only because I happen to be the head of the organization in India for research and development of agriculture and animal husbandry but also because by education, training and profession, I am an agriculturist and cattle breeder myself. Till the partition of the country in 1947, I had been a breeder of pedigree cattle of the Sahiwal breed which, as the delegates are aware, is one of the most important milch breeds of this subcontinent. Accordingly, I am keenly interested in the proceedings of the conference, in the various discussions regarding the experiences and observations of other countries in the course of their attempts at development of their own livestock and also in the practical suggestions, that may emerge out of the labours of this conference, for effecting the best and the quickest way of developing the vast livestock resources of India.

As delegates are aware, the Food and Agriculture Organization is one of the most vital limbs of the United Nations which strive ardently for ensuring permanent peace in the world. As has been rightly pointed out by the Director-General of the Organization, the best way in which permanent and enduring peace can be secured in the world is by ensuring that no human being dies for want of food. The FAO is devoting its energies towards the realization of this desideratum by pooling together the knowledge and experience gained by different countries and by applying this knowledge and experience for securing the maximum development of the potentialities for production. This particular conference is one among the chain of conferences, convened under international auspices for studying the reactions of livestock to tropical and subtropical environments and to apply the results of the study for promoting the productivity of livestock in the tropical countries of the world. Dr Phillips, the enthusiastic representative of the FAO, is no stranger to this country. We know him as an eminent geneticist and a keen student of the problems of livestock production. He has visited this country more than once, has surveyed the actual and potential resources in animal wealth and has himself prepared a publication on the subject. He is doubtless aware of the wide variety not only of the livestock but also of the environmental conditions in which they are bred and reared in India. He is also aware that India offers a wide scope for investigating productivity of livestock under tropical conditions, because the variety of the animals and their environments provide a base, sufficiently wide, for drawing valid conclusions.

The problem which faces India has been generally set out in the Memorandum presented by my delegation. As will be seen therefrom, India possesses livestock, some of which any country may be proud to own. At the same time, there is a large percentage of the population which are non-descript and are uneconomic as producers. The problem is, therefore, two-fold to improve the former by selective breeding and to increase the average productivity of the latter class of non-descripts by grading up. Certain attempts have been made to grade

*Speech delivered by Sardar Datar Singh as Chairman of the International Conference on Livestock Breeding at Lucknow.

up these animals by bulls of well-defined breeds, but much more work still remains to be done. The first essential thing is to investigate the problems connected with this grading-up work under varying conditions of soil, climate and husbandry. The second problem is the causes of deterioration of cattle in heavy rainfall and coastal regions and how these causes may be removed. The third problem is the organization that is required to be set up for dealing with this gigantic task. It will be seen from the note circulated by my delegation that India has apparently a large organization for the development of her livestock resources, but really the organization is not large enough for dealing with the development of quarter of the world's cattle population. How the research work done by this organization can be made to filter down to the actual cultivator and how best he can be persuaded to utilize fully the results of research, are other problems of a baffling nature.

The problem of finding food for the enormous population is another that should engage attention. It has been found by experience that the inadequacy of feeding is one of the well-known causes responsible for the low level of production. It has been estimated that the existing food resources of the country cannot supply more than a third of the requirements of her cattle. This problem may be peculiar to India because in other countries the density of human population is comparatively smaller and the competition between man and animal is not so severe. Generally, there is a flush of vegetation and an abundance of green fodder during and immediately after the monsoon, and scarcity during the dry season. The preservation of the surplus during the monsoon and the exploitation of the forest resources in fodder may be a possible solution.

In regard to the well-defined breeds of cattle, though a certain amount of improvement has been attained, the improvement is not sufficiently quick or substantial. Apart from the inadequacy of feeds, there may be other reasons which may be responsible for this slow pace of progress. Let me hope that the discussions and the exchange of ideas and experiences that take place in this assembly will result in evolving solutions for the more important aspects of such situations in all tropical countries.

Original Articles

CULTIVATION OF BANANA IN BIHAR

By R. S. ROY

BANANA (*Musa sapientum*) is one of the most important articles of diet of India. It has a historic importance. Alexandar, the Great, found the plant in the Indus Valley in 327 B.C. and Arabs seem to have introduced it, from India, into Palestine and Egypt. Today, among the fruits grown in our country, with the exception of the mango, the largest area is under banana cultivation. Madras comes first with over 128,000 acres and Bengal second with about 44,000 acres. Third in acreage is Bihar which has got an approximate acreage of 20,000 acres next only to mango in this State, the latter occupying an area of about 2,31,963 acres. The most important banana-area is north Bihar, specially the Hajipur tract of Muzaffarpur district and Samastipur and Begusarai areas of Darbhanga and Monghyr districts respectively. Alpan, also known as Chinia Champa, occupies about 60 per cent of the total acreage of bananas in Bihar.

Its importance

If the yields of all crops, under optimum conditions, are considered, banana stands first, the number of calories produced per acre being over 50,00,000. The sweet potato is the second best with 38,80,000 calories, while in respect of wheat and rice these are 12,60,000 and 12,80,000 respectively. In its per acre yield of proteins and carbohydrates also, the banana is markedly superior to rice, wheat and potato. In well kept plantations an annual yield of 60,000 lb. of banana per acre has been obtained. Banana provides all the ingredients of a balanced diet.

TABLE I

Composition of banana

Carbo-hydrate per cent	Protein per cent	Fat per cent	Calcium per cent	Some food factors found in 4 oz. sample			Calories
				Vitamin A	Vitamin B	Vitamin C	
36·4	1·3	0·2	0·01	T	5	1	153

A few bananas a day with milk provide a good amount of balanced nourishment specially to a sedantry worker. It is easily digestible and is used as a corrective both for over-weight and for combating diarrhœa as well as constipation. Persons allergic to milk or eggs have found the banana a delicious alternative.

R. S. ROY is Horticulturist to the Government of Bihar, P. O. Sabour, Dist. Bhagalpur.

Uses

Besides the fruit, the tender parts of the plant are also useful. The tender portion of the 'stem' is cooked and eaten; the ash of the plant contains a good percentage of potash and is used for washing clothes. Banana leaves are widely used as plates on ceremonial occasions and also as a thatching material for the poor man's hut. The stem serves as fodder for cattle. Experiments have shown that banana stems cut into short pieces can furnish as much as half of the

roughage for cattle. It is supposed to be a delicious fodder for elephants in Bihar. The flowers of banana, after a complete bunch of fruits has been formed, are freely used as cooked vegetable in some parts of the country. The fibre has also been found useful; for example the thick fibre is used for covering the ball of earth attached to roots of nursery plants; while the thin fibre is made use of in grafting and budding.

Green bananas are used as vegetables; they are also dried and ground into what is commonly called 'banana flour'. This is a cottage industry in Madras and on the West Coast of India.

Varieties in Bihar

Banana can be divided into two distinct classes, dessert variety and culinary variety. The dessert variety is generally called banana and the culinary or cooking variety is called plantain or *kachakela*.

Dessert varieties in Bihar: Sabja or Harichhal, Murtban, Barsain, Alpan or Chinia Champa, Malbhog, Sakar-Chinia, Kanaibhog, Anupan, Dhudhsagar, Agneshwar, Hajara, Amritsagar, Singlal, Sabri, Bombayred and Malabar, these are the names of some common varieties; of these the first five are most popular. A variety of Sabja grown in Patna city produced about 300-325 fruits per bunch.

Culinary varieties: There are many cooking or vegetable varieties, e.g. Muthia, Batisa, Bhos, Baghnar, Bethiga and Kothia. Some of these varieties being cheaper are also used as ripe table bananas in Bihar.

Wild bananas have also been found growing in some parts of Bihar. These varieties form viable seeds which are more or less of the size of a pea. Banana plants have been grown from such seeds.

A variety of banana is grown along the Nepal border of Bihar State which forms viable seeds; but ripe fruits have also been found to be quite delicious to eat though the flavour is not as good as Malbhog, Sabja or Chinia Champa.

A freak has been observed in Bombayred variety of banana at Sabour. A plant, 10 ft. in height, put forth inflorescence at 1½ ft. from the ground level. The inflorescence came out after breaking open the pseudostem.

Soil and climate

Banana flourishes in light and rich loamy soil. Banana can also be grown on clay soils by providing artificial drainage. Water-logging to a considerable extent has been found to be harmful though it appears to stand water-logging better than most other fruit crops. Banana has also been found to grow in Ranchi area of Bihar which has an average altitude of about 3,000 ft. Soil from the bottom of tanks has been found to be helpful to the growth of banana plants in Bihar.

Banana requires hot and dry climate with an average rainfall above 40 in. Frequent rainfall has been found to be helpful.

The plants need irrigation oftener in summer. In Bihar three or four irrigations a month from December to May or June, before the break of monsoon, are beneficial. A variety of banana, known as Barsain and grown in the Hajipur area of Bihar, can grow without much irrigation. It has been observed to be drought resistant. Other varieties such as Alpan, Malbhog and Murtban require a good deal of irrigation. The cultivation of Malbhog and Alpan is decreasing in North Bihar (Hajipur) due to root rot and wilt diseases which have been found to be quite common there. The causes of deterioration of Malbhog and Alpan bananas in this area should be investigated.

Laying out and planting time

Bananas are commonly planted in home yards or in regular plots in large-scale cultivation in Bihar. After preparing the plot of land, pits are dug with diameters of 3 ft. $\times$ 3 ft. with a spacing of 10 ft. from plant to plant. Pits are dug in the beginning of May. The soil should be exposed to the sun for about a fortnight, so that germs and pests might die. The pits should be refilled after mixing the soil thoroughly with the ingredients mentioned below; the quantities of each required per pit are also given.

Cowdung	..	½ maund
Woodash	..	10 seers
Compost	..	10 seers
or		
Castorcake	..	1 seer

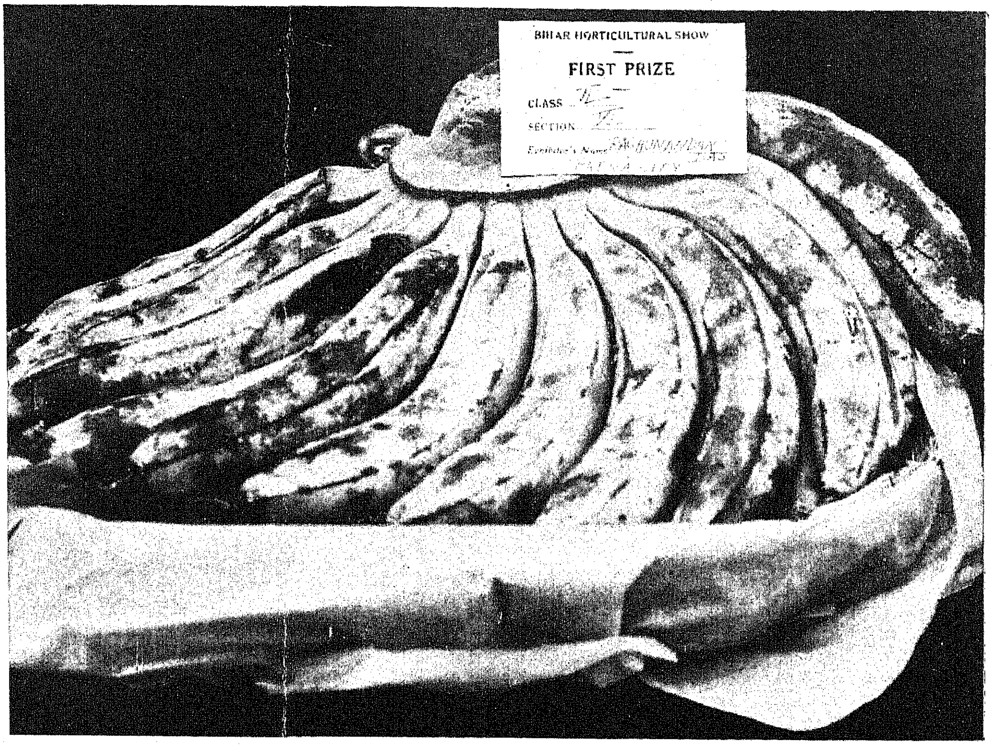

FIG. 1. Sabja variety grown in Patna City

FIG. 2. Banana plants grown from seeds

FIG. 3. Some important varieties of dessert and culinary banana grown in Bihar

PLATE 40

FIGS. 4 and 5. Flowering of Bombyred from $1\frac{1}{2}$ ft. from ground level

If the soil is too light, few baskets of tank silt should be added and mixed with the soil by the end of May or beginning of June before refilling. The refilling should be done in such a way that the soil of each pit remains 6 in. above the ground level ; when rains set in the soil over the pits sink to the ground level.

The most suitable time for planting banana in Bihar is between July and August although in north Bihar the planting is commonly done up to November or December. Two or three months old suckers should be selected and planted firmly in the pits, one in each.

Manuring

The best time for manuring banana has been found to be February and July. Banana requires more than usual amount of potash and so the addition of ash is essential. Each grove of banana should be manured as per schedule given below :

Farmyard manure ..	20 seers	per plant
Ash	10 ,,	
Compost ..	10 ,,	
or		
Castorcake ..	1 seer	

The manures should be properly mixed with soil before application.

Care of plants

Weeding should often be done round the *thallas* of bananas. During hot weather the *thallas* should be kept deep round the plant so as to retain water but during the rains they should be raised and made sloping away from the plant to avoid water-logging. Four or five suckers per plant are generally allowed for continuous and good fruiting ; rest of the suckers should be removed and planted elsewhere. Banana is commonly propagated by suckers or corms.

Irrigation

Irrigation is given from December to June only. Three irrigations per month have been found to be quite suitable under conditions obtaining in Bihar.

The best system of irrigation for banana is the *thalla* system. A drain is made in between the alternate rows of plants and sub-drains are made to connect *thallas* with the drain. The *thallas* should be deep but sloping away from the main plant. Irrigation should be given immediately after manurial operations.

Intercrop

So long as the plants are one year old it is advisable to plant some intercrop like brinjals, chillies, tomato, cabbage, cauliflower and radish, etc.

Fruiting and ripening

Generally banana flowers and fruits in 12 to 18 months after planting. During summer the fruits take about three months to mature and ripen but during winter they take about four months or so from the time of flowering ; the period, however, varies with different varieties. Support is necessary in case of big fruit bunches.

Rotation

It is essential that banana plants should not be allowed to continue for long in the same plot of land as such a practice is definitely harmful both to the soil and to the plants themselves. There are many insects and fungi which multiply if the plants are kept long and these damage the banana groves. After every three years the land should be utilized for other field crops in order to allow the exhausted soil to recoup its fertility.

Pests and diseases

One of the most important causes of the root rot disease of banana is the failure to remove the old roots when a bunch has been harvested and stem destroyed. If the roots are left in the soil, rotting sets in which ultimately results in the formation of rosette of leaves of banana. The banana plant is also attacked by stem borer. The pest penetrates into the stem and destroys the whole plant. In this case the affected plant must be cut and destroyed. Fruits are attacked by maggots ; such fruits should be destroyed immediately. Fruit maggots have

been observed on Malbhog and Murtban varieties in the Hajipur area. Banana wilt, also known as Panama disease, has been observed in Bihar. Fruit splitting has been observed in some cases which is due, generally, to a wet period followed by drought or vice versa.

Economics of banana cultivation

First year:

A statement of income and expenditure per acre of banana cultivation is given below :

1. Ploughing of land and levelling	Rs. 10
2. Laying out and digging pits, etc. (435)	,, 63
3. Manuring and refilling pits ..	,, 107
4. Irrigations (eight) ..	,, 50
5. Hoeing and weeding (three times)	,, 30
6. Cost of watching for four months at Rs. 20 p.m. ..	,, 80
7. Cost of 435 suckers ..	,, 100
8. Control of pests and diseases	,, 10
9. Rent of land	,, 20
10. Other expenses	,, 35
Total expenditure ..	,, 505
Income from the sale of 350 bunches at Rs. 2 each	,, 700
Income from the sale of 350 spikes for vegetables at 6 pies each	,, 11
Total income ..	,, 711
Net profit for the first year ..	,, 206

Second year :

1. Cost of manuring ..	Rs. 107
2. Cost of irrigation ..	,, 50
3. Cost of hoeing and weeding	,, 30
4. Cost of watching for six months	Rs. 120
5. Cost of control of pests and diseases	,, 10
6. Rent of land	,, 20
7. Miscellaneous expenses	,, 30
Total expenditure ..	,, 367
1. Income from the sale of 870 bunches two per grove Re. 1 as. 12	,, 1,522-8
2. Income from the sale of 870 suckers to be sold at as. 2 ..	,, 108-12
3. Income from the sale of 870 spikes at 6 pies each ..	,, 27-3
Total income ..	Rs. 1.658-7
Net profit in the second year ..	,, 1,291-7

Thus from the second year onwards the net annual profit is not likely to be less than Rs. 1,291 per acre.

Considering the production of banana, the consumption in Bihar is less as compared to that in Bengal and Madras. The consumption figures for other parts of the country stand low although naturally at the centres of production the consumption is much greater. Lack of transport may not be the only explanation for this uneven distribution of consumption figures. The value of banana as an article of diet should be made more widely known, and greater efforts should be made to popularize the fruit as an essential item in the daily dietary of our countrymen. Government of India is determined to stop the import of food by 1951 and the production of subsidiary crops like banana and sweet potato has been stressed to overcome food shortage. Its cultivation should therefore be taken up as a part of the national drive for self-sufficiency in food.

CERTAIN PRELIMINARY STUDIES IN THE CONTROL OF CARDAMOM THRIPS

M. S. SUBBIAH

CARDAMOM (*Elettaria cardamomum*) is one of the most important among the commercial spice crops and has in recent times been fetching very attractive prices in the market. The crop thrives best in areas where the rainfall is not only heavy but also well distributed throughout the year and its cultivation, therefore, is at present restricted to the submontane tracts of the Western Ghats at elevations of 2,500 to 4,000 ft. Besides proper elevation and rainfall, the crop also needs adequate natural shade. Plantations are, therefore, laid out usually in evergreen *sholas* well protected from high winds. The crop is propagated either from bulbs or from two years' old seedlings raised in carefully prepared nurseries, the planting being done during May-June, just before the monsoon rains. Apart from occasional gap-filling and weeding, the crop needs very little by way of after-care. Flowering commences from the third year after planting and continues practically throughout the year. There may be about eight pickings in a year, with a peak period from September to December, corresponding to the peak of flowering between May and August. Normal bearing can be expected from the fifth year onwards and continues up to the fifteenth year. With an average annual yield of about 120 lb. of dry pods per acre.

Important insect pest

One of the main factors that prevents any large-scale extension of the area under this profitable spice crop is the damage caused by insect pests, of which the most important is the Cardamom thrips (*Taeniothrips cardamomi*). The damage is sometimes so severe that the entire crop is ruined in certain years and in certain cases the whole plantation has to be abandoned. It is now prevalent in all the cardamom areas in South India and the loss caused by this pest is increasing every year. In view of the serious nature of this pest, a scheme of research for its control was initiated by the Indian Council of Agricultural Research in October, 1944, and this note summarizes the results and information secured in the course of the four years that the investigation has been in progress.

The pest, *Taeniothrips cardamomi* is a very small dark brown insect provided with lacerating and sucking mouthparts. The eggs are laid inside the tender tissues of the leafsheaths, spindles or flower bracts, out of which the wingless nymphs hatch out in a week's time. They moult thrice in the course of three weeks and then pupate for 10 to 15 days before emerging as adults. The whole life cycle is thus completed in 32 to 46 days. The insects hide under the leafsheaths, spindles, floral bracts, flowers and on tender fruits and feed in large numbers on the plant sap. Due to the heavy drain on the plants, the flowers and young fruits wither away and drop off. The few fruits that are retained on the plant are distorted in shape, with characteristic scabs on the surface, due to the scraping by the thrips. Such pods are not only undersized, but have also no flavour or aroma in the seeds inside them and hence these fetch a very poor price in the market. The damage, therefore, consists in a reduction of both yield and quality. As an example, the yield in one particular case was reduced to 16 lb. per acre, whereas in normal years it was 120 lb. per acre. This sudden decline is to be attributed only to the rapid increase of thrips, since the season was quite a normal one and the area too was the same as in the previous seasons.

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Control methods

Preliminary studies on the efficacy of various control methods were commenced in 1946 at Singampatti (Tirunelvelli District) and, in the following year, these were extended by laying out field experiments capable of statistical evaluation using the following insecticides: nicotine sulphate both as a spray and as a dust, tartar emetic and Gammexane. As a spray, 5 c.c. of 40 per cent nicotine sulphate were mixed in a gallon of water along with half an ounce of soft soap and sprayed at the rate of 20 gallons per acre. When used as a dust, 25 c.c. of 40 per cent nicotine sulphate solution was incorporated in one pound of fine china clay dust and dusted at the rate of three to four pounds per acre. Tartar emetic was used as a bait-spray which was prepared by dissolving 6 oz. of the substance in 15 gallons of water, with one pound of molasses and was used at the rate of 15 gallons per acre. Gammexane (D. 025) was dusted as received from the suppliers, the Imperial Chemical Industries (India) Ltd., Madras. The plots were randomized and each treatment—along with untreated as controls—was replicated five times in plots of 6·6 cents each containing about 36 clumps. The treatments were continued at monthly intervals from March, 1946 till July, 1948. With a view to avoid waste, these insecticides were used only on the fruit-bearing panicles in each clump and no attempt was made to cover the entire clump.

Ripe fruits from the individual plots were collected, weighed and recorded once a month. A random 100 gm. sample from the produce of each plot was examined and graded into free and scabbed pods. The proportions of the different grades of pods from the produce of each of the treatments were worked out for the season. The summary of the results obtained in two experiments is given in Table I.

An attempt was made in 1947-48 season, to see whether it was sufficient to apply the insecticides in alternate months instead of every month, the area of randomized plots and the number of clumps in each being the same as before. The data given below in Table II will show that the interval between applications should not be more than a month for efficient control.

TABLE I

Effect of various insecticides on cardamom thrips

Treatments*	1946-47			1947-48		
	Percentage of infestation in pods	Mean yield of dry pods in lb. per acre	Percentage of increase on control	Percentage of infestation in pods	Mean yield of dry pods in lb. per acre	Percentage of increase on control
1.	34	135·3	453	40	83·6	653
2.	33	68·7	229	23	48·0	375
3.	71	57·2	191	77	27·4	214
4	88	26·8	90	88	13·5	105
5.	90	29·9	100	88	12·8	100

* *Index to treatments* :
1. Nicotine sulphate (spray)
2. Gammexane dust
3. Nicotine sulphate (dust)
4. Tartar emetic (Bait-spray)
5. Control

TABLE II

Efficacy of insecticides in relation to interval between treatments

(1947-48 season)

Treatments—11

Replications—5 in randomized plots of 6 cents area each containing about 36 clumps

Treatments	Infestation on pods per cent	Mean yield of dry pods per acre	Increase on control per cent
1. Nicotine sulphate at 0·05 at 20 gallons per acre at monthly intervals (spray)	51	110·8	361
2. Same as above in alternate months	71	82·6	269
3. Gammexane (D. 025) at 3 lb. per acre at monthly intervals ..	33	123·3	344
4. Same as above in alternate months	58	52·8	172
5. Gammexane plus china clay at 3 lb. per acre at 1 : 1 at monthly intervals	55	63·1	206
6. Same as above in alternate months	67	91·5	298
7. Gammexane plus tobacco dust at 3 lb. per acre: at 3 lb. per acre at monthly intervals ..	42	71·0	231
8. Same as above in alternate months	61	84·1	274
9. Tobacco dust alone at 3 lb. per acre at monthly intervals ..	72	58·2	196
10. Same as above in alternate months	84	39·9	130
11. Control—no treatment in all ..	88	30·7	100

It would be clear that in every case, the percentage of infestation is higher and the average yield of pods lower when the insecticides are applied in alternate months, as compared with their monthly application. Hence for efficient control of thrips on cardamoms, the interval between successive treatments should not be longer than a month. And further, it would be clear from Table II, that the most effective treatments are only two, namely Gammexane D. 025, dusted at the rate of 3 lb. per acre every month without any admixture with other materials, and nicotine sulphate, sprayed at monthly intervals at a concentration of 0·05 per cent and at the rate of 20 gallons per acre. These two treatments are definitely superior to all other treatments both from the point of view of higher yield as well as low infestation by thrips.

Economics of the insecticidal treatment

The cost of treatments and the value of the resultant produce are calculated and set out for comparison in Tables III and IV for assessing the economics of the different insecticidal treatments.

TABLE III

Cost of various insecticidal treatments

Insecticide and labour	Cost of treating an acre once				Cost of 12 monthly trials or 12 treatments	Cost of six trials on alternate months or six treatments
	How applied	Insecticide	Labour at Rs. 1-4-6 per man	Total		
		Rs. as. p.	Rs. as. p.	Rs. as. p.	Rs. as. p.	Rs. as. p.
1. Nicotine sulphate $3\frac{1}{2}$ oz. of 40 per cent solution at Rs. 12 per lb.	Spray	2 10 0	..	..	..	..
Soap ..		0 4 6	..	..	..	..
3 men ..		..	3 13 6	6 12 0	81 0 0	40 8 0
2. Gammexane 4 lb. at Re. 0-9-6 per lb. ..	Dust	2 6 0	..	..	..	..
1/3 man ..		..	0 7 0	2 13 0	33 12 0	16 14 0
3. Gammexane and clay	China dust					
Gammexane 2 lb. ..		1 3 0	..	..	..	..
China clay 2 lb. ..		0 2 0	..	..	..	..
1/3 man ..		..	0 7 0	1 12 0	21 0 0	10 8 0
4. Gammexane and tobacco	Dust					
Gammexane 2 lb. ..		1 3 0	..	..	..	..
Tobacco dust 2 lb. ..		1 11 6	..	..	..	..
1/3 man ..		..	0 7 0	3 5 6	40 2 0	20 1 0
5. Tobacco 4 lb. ..	Dust	6 14 0	..	..	..	..
1/3 man ..		..	0 7 0	7 5 0	87 12 0	43 14 0
6. 40 per cent nicotine sulphate solution 100 c.c. ..	Dust	2 10 0	..	..	..	..
China clay 4 lb. ..		0 4 0	..	..	..	..
1/2 man ..		..	0 11 0	3 9 0	42 12 0	21 6 0
7. Tartar emetic ..	Bait-spray	1 0 0	..	..	..	..
Molasses ..		0 2 0	..	..	..	..
1 man ..		..	1 4 6	2 6 6	28 14 0	14 7 0

For assessing the gross value of the produce from each of the treatments, the proportion of scab-free, lightly scabbed, medium scabbed and heavily scabbed pods were worked out on acre basis and their values calculated at the current market rates as follows :

Price per lb.	Scab-free	Lightly scabbed	Medium scabbed	Heavily scabbed
	Rs. as. p.	Rs. as. p.	Rs. as. p.	Rs. as. p.
1946–47	3 2 0	2 14 0	2 8 0	1 8 0
1947–48	3 8 3	3 3 1	2 12 0	1 12 0

On the basis of values given above, the net gain or loss for the various treatments over the controls were worked out as given below.

TABLE IV

Economics of the different treatments

Layout : Randomized blocks of 6·6 cents with 36 clumps

Treatments started in March, 1946 and continued till April 1948

Treatments : 5

Replications : 5

(Mean of 10 monthly pickings)

Treatments	Percentage of scab-free pods by weight	Mean yield of dry pods per acre	Percentage of increase on control	Value of produce	Cost of treatments	Net value of produce	Profit or loss over control
				Rs. as.	Rs. as.	Rs. as.	Rs. as.
Experiment No. 1 (1946-47 season)							
Nicotine sulphate (spray)	66	135·3	453	383 6	81 0	302 6	245 6
Gammexane (dust) ..	67	68·7	229	193 12	33 12	160 1	103 1
Nicotine sulphate (dust) ..	29	57·2	191	133 5	42 12	90 9	33 9
Tartar emetic (bait-spray)	12	26·8	90	54 7	28 14	25 9	31 7
Control ..	10	29·9	100	57 0	..	57 0	..
Experiment No. 2 (1947-48 season)							
Nicotine sulphate (spray)	60	83·6	653	267 13	81 0	186 13	159 2
Gammexane (dust) ..	77	48·0	375	168 12	33 12	135 0	107 5
Nicotine sulphate (dust) ..	23	27·4	214	67 9	42 12	24 13	2 14
Tartar emetic (bait-spray)	18	13·5	105	29 8	28 14	0 10	27 1
Control ..	12	12·8	100	27 11	..	27 11	..

TABLE V

Effect of applying insecticides monthly and in alternate months

Experiment No. 3 (*1947-48 season*)

Layout : Randomized plots 6·6 cents including 36 clumps in each plot

Treatments started in March, 1947 and continued till March, 1949

Treatment : 11

Replications : 4·5

Treatments	Percentage of scab-free pods by weight	Mean yield of dry pods per acre	Percentage of increase on control	Value of produce	Cost of treatments	Net value of produce	Profit or loss over control
(Applied every month)				Rs. as.	Rs. as.	Rs. as.	Rs. as.
Nicotine sulphate (spray)	49	110·8	361	340 1	81 0	259 1	191 7
Gammexane (dust) ..	57	123·3	402	411 13	33 12	378 1	310 7
Gammexane plus china clay (dust) ..	45	63·1	206	188 3	21 0	167 3	99 9
Gammexane plus tobacco dust	58	71·0	231	227 6	40 2	187 4	119 10
Tobacco dust ..	28	58·2	190	182 10	87 12	94 14	27 4
(Applied in alternate months)							
Nicotine sulphate (spray)	29	82·6	270	218 6	40 8	178 14	111 4
Gammexane (dust) ..	42	52·8	172	154 2	16 14	137 4	69 10
Gammexane plus china clay (dust) ..	33	91·5	298	247 6	10 8	236 14	169 4
Gammexane plus tobacco dust ..	38	84·1	274	239 2	20 1	219 1	151 7
Tobacco dust ..	16	39·9	130	91 10	43 14	47 12	19 14
Control (untreated) ..	12	30·7	100	67 10	..	67 10	..

It is evident from the data presented above that plots treated with Gammexane or nicotine sulphate give a higher yield with a greater proportion of scab-free pods and thus bring in a higher return per acre. The money spent in treating the plants with insecticides and care bestowed on them are amply compensated, by the higher profits secured from the plots so treated.

Conclusion

The data presented in Tables IV and V make it clear that it is necessary to apply the insecticides at least once a month if effective control of thrips is to be secured. Any attempt at economizing on labour or material by applying the insecticides at two-month intervals is seen to be comparatively ineffective so far as the pest control is concerned.

The area of a cardamom plantatoin varies from 50 to 1,000 acres. Hence the choice of an insecticide rests on ready availability, ease of application and greater coverage in a shorter period. Besides, as rains are of frequent occurrence in a cardamom area, the operations have often to be stopped for brief periods during spells of rain and even for days together at times according to the weather conditions. The insecticide prepared for use should be of such a nature that it would not deteriorate if left over.

Judged from this view point nicotine sulphate, though an efficient insecticide, has its limitations especially for a crop like cardamom. The application of a liquid spray to cardamom plants in such hilly areas is also apt to be a very laborious process. It may perhaps be suggested that tobacco decoction might be a cheaper substitute. But now, on account of the imposition of an excise duty on tobacco, it is not an easy matter for the ordinary farmer to secure the material he needs for use as an insecticide. It is also not much cheaper than nicotine sulphate and involves heavy transport charges as the material has to be taken on headloads to the plantations. Above all, both nicotine sulphate and tobacco decoction deteriorate very rapidly, if kept over for more than a day.

On the other hand, Gammexane in the form of a dust is very readily available, easy to transport and very convenient for application. Any unused or surplus insecticide can be kept over without danger of deterioration for subsequent use.

Considering these advantages, as well as its efficacy in controlling thrips on cardamom plants, the use of Gammexane is to be recommended in preference to other insecticides like nicotine sulphate or tobacco dust.

Acknowledgments

The writer is deeply indebted to Shri K. M. Thomas, Government Mycologist till 1948 and to Shri M. C. Cherian, Government Entomologist, for their sustained interest and encouragement throughout the period these experiments were in progress. Thanks are also due to the Indian Council of Agricultural Research for according permission to publish these results. The help given by Shri E. V. Abraham in the course of the investigationr is also acknowledged with thanks.

BRUCELLOSIS OF MILCH ANIMALS IN INDIA

By K. C. SINHA

IT is well known that the *per capita* milk consumption in India is the lowest among the civilized countries of the world. A satisfactory level can be reached if the production is increased threefolds. Moreover, contrary to the popular notion that India has an enormous cattle population, the number of cattle as compared to the vast area of this country is indeed small. These facts at once stress the need for not only more productive and disease-free herds but also for more animals. At the bottom of all efforts at improving the milk position in India lies the problem of disease control. Among the diseases which render the dairy enterprise hazardous, brucellosis or contagious abortion is one. It not only causes abortion but the consequences are more far reaching than ordinarily realized. The milk yield declines abruptly and sometimes the animals go dry, still others fail to conceive. Above all, the calf is lost. Besides, it is a public health problem as well. Handling of infected material and consumption of raw milk from infected cows causes in man nonspecific fever similar to 'undulant' or 'Malta fever' which is a specific infection caused by *Brucilla melitensis* found in goats.

What brucellosis means to India

In India, brucellosis causes abortion to the extent of one to five per cent per annum. In certain badly affected areas 30 per cent of animals are found to be infected and the abortion rate rises as high as 10 per cent. If the management is bad and the animals are allowed to remain in unhygienic environments and if the climatic conditions are also exacting, viz. humid together with heavy rainfall,—brucellosis can cause abortion in 20 to 40 per cent of the pregnant animals. The annual loss of calves in well managed herds may be only one to three per cent but in badly managed farms it may even be to the extent of 25 per cent. Further, the incidence of sterility among the *Brucella*-infected animals is by no means small. In one instance 16 per cent of *Brucella*-infected cows were found to be sterile. Judging from these figures the annual loss due to brucellosis in India can easily be estimated. In cases in which milch animals are owned by individuals the loss is more keenly felt. Assuming that a farmer's cow aborts in the third month of pregnancy, he has to feed it for one and a half year without any return. This would mean a loss of nearly 500 rupees apart from the loss due to the death of the calf.

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Incidence

Brucellosis is found to exist all over India. It is present in farms in Shillong, Calcutta, Patna, Lucknow and Delhi, as also in farms in Madhya Pradesh, Bombay and Hyderabad. The incidence of brucellosis in village herds is very high in wet and humid areas with heavy rainfall.

Cause

Contagious abortion is caused by minute germs known as *Brucella*. They are named after Sir David Bruce who first described them. These germs cause irritation of the gravid uterus and the fœtus is expelled prematurely.

Susceptibility

Cows, buffaloes, goats, sheep and pigs are all susceptible. Pregnant animals are more susceptible than non-pregnant ones, while female calves are resistant. European and cross-bred cows are more susceptible than Indian cows and buffaloes. It is opined that the greater the proportion of foreign blood in an Indian cow, the greater is its susceptibility to brucellosis. There is little difference in the susceptibilities of cows and buffaloes to brucellosis but the susceptibility of the latter can be

increased if they are kept in special environments which tend to interfere with their natural inclinations.

Dissemination

The infected cow or buffalo can spread the disease in two ways ; one is by way of discharges from the uterus and the other by the bacteria in milk. Of the two, the former source is more important. Uterine discharges, urine, foetal membranes and the aborted foetus contain numerous germs which can soil the pasture, feed, bedding and even parts of cattle sheds. Cattle attendants handling these infected materials may also spread the disease from one place to another. The germs can survive for a long time if the cattle shed is wet, humid and dark whereas they perish quickly if there is provision for direct sunlight and good ventilation. Among buffaloes, the pond water may act as a very convenient agent for spreading the disease. Buffaloes have a natural inclination to wallow in shallow ponds during the greater part of the year. A buffalo which has aborted recently may enter the pond and contaminate the water in which case all the buffaloes wallowing therein may get infected. Bulls carrying *Brucella* germs can infect cows while mating. Flies can carry the germs from the diseased animal to the healthy ones.

Symptoms

There are not many alarming symptoms of this disease. The cow or the buffalo shows symptoms of calving. The milk yield declines and the secretion resembles colostrum. The foetus is expelled usually between the fifth and six months of pregnancy. The calf is expelled dead or very weak. The foetal membranes appear mutilated, swollen and unhealthy. Usually the foetal membranes get stuck to the uterine wall and this causes retention of placenta. When the placenta attached to the uterine wall gets septic, there follow several untoward after-effects and these may lead to permanent impairment of the reproductive efficiency resulting in sterility.

Diagnosis

Brucellosis can be diagnosed by the examination of the uterine discharge, foetal membranes, the heart blood or the stomach contents of the foetus. It is now possible to detect animals carrying *Brucella* germs by a test known as 'agglutination test'. Milk, whey, blood or serum can be used for this test. In some cases repeated examinations are necessary. Whenever there is any suspicion of brucellosis a competent veterinarian be consulted.

Eradication

All advanced countries in the world are trying hard to stamp out this disease. It may sound something like an impossible task but in some places *Brucella*-free herds have been raised and maintained for years together. All eradication programmes include two items, viz. prevention and control. There is no treatment available which could cure brucellosis and as such all efforts are concentrated on prevention and control of the disease in an infected herd. Any programme of eradication should take well into account the questions of hygiene and vaccination.

Hygiene

In well managed farms, where facilities exist, separate calving pens may be constructed away from the infected cows or buffaloes or from places where they have aborted. In this way healthy animals can be kept away from the diseased ones. It is known that when the cow aborts for the first time, the uterine discharges remain infective for at least three months. Therefore, when an animal aborts for the first time, it should be kept segregated for at least three months after the abortion. During the second pregnancy the animal may be segregated at least for four weeks before and six weeks after parturition. For the third and fourth pregnancies the animal may be segregated from the healthy ones for four weeks before parturition and a few days after it till the vaginal discharges have ceased. These precautions relate to well managed farms. But when there is a case of abortion among two or three cows belonging to a poor farmer, such precautions cannot ordinarily be expected to be taken. In such a case the farmer

may be instructed to burn the bedding soiled with uterine and vaginal discharges and keep his cow shed clean. He should wash his hands with potassium permanganate solution (1 : 500) or bleaching powder solution before attending healthy cows. The vagina of the cow may be douched with potassium permanganate solution twice a week for about six weeks after the abortion. The farmer may avoid over-crowding in the cow shed. If he has a pregnant buffalo and learns that a buffalo has aborted in the neighbourhood, he would be wise not to allow his buffalo to run to the common village pond to wallow. A few buckets of cold water sprinkled or splashed twice or thrice daily over the animal's body will keep it fit. Where infected cases exist a separate bull may be used for the healthy stock or recourse should be taken to artificial insemination.

It is always a wise policy to test the blood of all pregnant and even non-pregnant cows. Infected animals can be maintained separately from the clean ones. Regular 'agglutination tests' and segregation of the positive cases help in raising healthy, disease-free herds.

Calves born of infected mothers should be kept separate and should be fed on boiled milk if the milk supply is from an infected cow or buffalo.

Vaccination : Vaccination is becoming increasingly popular in India. Calves between four and eight months of age may be vaccinated with 5 c.c. of the vaccine. The resistance against *Brucella* infection produced by this vaccine lasts throughout the life of the animal vaccinated. In special cases, older animals can also be vaccinated. There are no untoward symptoms except a slight rise of body temperature and local swelling. The vaccine is at present manufactured at the Indian Veterinary Research Institute, Mukteswar—Kumaun, Uttar Pradesh. Vaccination should be carried out under the supervision of a veterinary surgeon.

A HORMONE FOR IMPROVING FRUIT SET AND INDUCING SEEDLESSNESS IN TOMATOES

By L. VENKATARATNAM

MINUTE quantities of certain organic compounds known as hormones regulate the growth of plants. Their discovery in plants, isolation and artificial synthesis have helped workers to make outstanding progress in agricultural science. In recent years, the study of plant hormones has become a fascinating and fruitful line of research.

At present several plant hormone products are available with commercial firms for controlling the growth processes in plants. Patent hormone preparations are available for stimulating root production, eradicating or suppressing weed growth, stimulating or preventing sprouting in tubers, improving fruit set or reducing excessive blossoms, and for many other reactions. Among these, inducing parthenocarpy in commercial fruits by the use of growth substances and synthetic commercial products is a comparatively recent development having great potentialities. Trials are in progress at the Agricultural College, Bapatla, to assess the effects of commercial plant hormone products, with a view to standardize them under conditions obtaining in this region. One of the several plant hormone products under trial was β-napthoxy acetic acid, the active principle of P. P. Tomato set. The results of the performance of this hormone are reported in this article.

Methods

In the trials at Bapatla, only small bottle sprayers were used. The hormone was diluted in water at the specified concentration and filled in the bottle attached to the sprayer and was sprayed on flower clusters in tomatoes. This method is simple and no other equipment is necessary. The hormone was sprayed as far as possible fresh every time at the specified concentration on flower clusters alone without wetting stems or leaves.

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Experiments

In the experiments detailed below, P. P. Tomato set containing β-napthoxy acetic acid was used. At first before the opening of the flowers, on mature buds the hormone was sprayed at 1 in 100 concentration after cutting the stigma with a fine pointed scissors. The flowers in tomatoes thus sprayed were left as such and were not bagged. Later adopting the same technique, cutting the stigma in mature buds before their opening, the hormone was sprayed after dilution with water at different concentration. Table I shows the response thus obtained.

TABLE I

Response of flowers to spraying

Number of flowers sprayed	Concentration of P.P. Tomato set in water	Number of flowers set	Number of mature fruits developed parthenocarpically
50	1 : 100	13	9
50	1 : 150*	28	21
50	1 : 1000	33	29
50	1 : 1500	42	40
50	1 : 2000	29	24
50	1 : 2500	22	17

* Dosage commonly recommended by the manufacturers.

It will be seen that a far lower concentration than 1 in 150, recommended by the manufacturers, is comparatively more effective in improving fruit set and inducing

parthenocarpy. The optimum dilution is found to be 1 in 1500, as further dilutions with water have shown lower fruit set.

Tomatoes were grown in cement tubs and the hormone was sprayed at 1 in 1500 dilution with water during the flowering period regularly on flower clusters on alternate days till fruit set was noticed. The data are presented in Table II.

TABLE II

Performance of tomatoes sprayed under pot house conditions

Particulars	Treated	Untreated
Number of plants used ..	12	12
Total number of flowers produced ..	237	243
Number of flowers sprayed with the hormone ..	181	*nil*
Number of flowers that set fruit ..	151	89
Percentage of flowers that set ..	64	43
Number of mature fruits harvested ..	51	34
Number of fruits developed seedless ..	51	*nil*
Percentage of seedless fruits produced ..	100	*nil*
Total weight of fruits ..	87 gm.	636 gm.
Mean weight of fruit ..	17·3 gm.	18·7 gm.

It will be seen from Table II that by spraying the hormone at regular intervals complete seedlessness could be achieved. Further, about twenty per cent increase in fruit-set had also been secured. No improvement with hormone-treatment could be observed in the size of fruits; this may probably be due to the greater number of fruits borne by the plants that received the hormone spray.

A third trial was conducted under field conditions, to seek confirmation of the above observations, by spraying the hormone on flower clusters twice a week, in a small strip of plot selected in the field. Four consecutive rows of tomato plants were selected and the alternate ones were sprayed with hormone and the other two were left as such to serve as control. On an average each flower cluster received two sprayings. Table III shows the performance of the plants sprayed under field conditions.

TABLE III

Performance of plants sprayed under field conditions

Particulars	Treated	Untreated
Number of plants selected	24	24
Number of fruits harvested	1,755	1,388
Number of fruits borne per plant ..	73·1	57·8
Total weight of fruits harvested ..	109·31 lb.	107.5 lb.
Average weight of each fruit ..	1·0 oz.	1·24 oz.
Number of fruits developed seedless ..	184	*nil*
Percentage of seedlessness	14·2	*nil*
Percentage increase in fruit-set over control ..	15·3	..

Even under field conditions, it would be seen that an appreciable improvement in fruit-set, with moderate percentage of seedless fruits, resulted by spraying, even at long intervals, with the hormone diluted with water in the ratio of 1 in 1500.

Better tomato crop

From the trials described above, it is clear that the hormone induces parthenocarpy and does not cause any injury to the plant when sprayed at the optimum concentration. Without emasculation or protecting the flowers from natural pollination, even under field conditions, it has been possible to secure parthenocarpy. It is likely that the hormone has greater influence on the ovary in stimulating the development of the tissues than that resulting from natural pollination. From the performance of tomatoes under pot conditions, maximum fruit-set and seedlessness are found to result if the hormone is sprayed just before the opening of the flowers. It is possible to get such results only if the hormone is sprayed regularly on the flower clusters in each plant. This may perhaps

not be possible on a large scale. But it may be pointed out that harvesting of fruits is done by collection from each plant as and when the fruits reach maturity. Spectacular results can be achieved by paying similar attention to flower clusters as soon as flowering commences and spraying the hormone regularly on the flower clusters. It has been reported by several workers that tomatoes harvested from the sprayed plants are better developed, uniform and slightly better in quality and colour. Consequently these are likely to fetch better return as compared to the fruits produced under normal conditions. From the point of view of increased fruit-setting and low cost involved in attaining the objective, this hormone is likely to be helpful in securing better tomato crop.

Acknowledgment

The author is grateful to Shri P. V. Ràmiah, M.A., B.Sc. (Edin.), Principal, Agricultural College, for his valuable suggestions and for giving me facilities for this work. Thanks are also due to Shri K. Divakaran for rendering the necessary help in the conduct of the trial.

THE OPEN-BILLED STORK DAMAGING PADDY FIELDS

WHILE investigating the possibilities of fish culture in the paddy fields of the Sundarban Abads in the 24-Parganas during 1944-45, some Open-billed Stork, *Anastomus Oscitans* (Boddaert), were noticed frequenting paddy fields. On enquiry it was learnt that before the harvesting season, towards November-December, when the waters are low or almost dried up, these birds visit the fields in flocks and do considerable damage to the paddy crop by trampling over the plants. Locally these birds are known as *samuck-khel* in which reference is made to their feeding on the large *Ampullaria* or *Pila* snails (*samuck* in Bengali). The thickly grown paddy fields are not much affected since the snails, frogs, crabs, fish, etc. cannot be sighted from the air, whereas in sparsely grown fields these animals lie more or less exposed and fall an easy prey to the Open-billed Stork. So far as it could be ascertained, the local people adopted no special measures to scare them off.

The fauna of the paddy fields consists of the following :

1. *Crustacea : Metapenaeus brevicornis ; M. monoaros ; Paratelphusa (Paratelphusa) spinigera.*
2. *Mollusca : Pila globosa ; Vivipara bengalensis ; Malania* and *Melanoides* species.
3. *Pisces : Puntius ticto ; P. sephore ; Rasbore daniconius ; Esomus danricus ; Oryzias melanostigma ; Ophicephalus gachua ; O. punctatus ; Anabas testudineus.*
4. *Bactrachia : Rana Tigrina* and *R. cyanophlyctis.*
5. *Ophidia : Tropidonotus piscator.*

IMPROVED VARIETIES OF PULSES AND LESSER MILLETS FOR GUJERAT

By G. K. GOVANDE

THE problem of adequate foodgrain supplies to the ever-growing population in India is of major importance; and, as a surest method of augmenting these supplies, the breeding of better yielding varieties of food crops needs no further emphasis. The Indian Council of Agricultural Research have, therefore, been financing breeding projects throughout the country on a coordinated basis. One of these schemes was for the improvement of some of the pulses and lesser millets in Baroda State (which has since been amalgamated with Bombay) and was financed jointly by the Council and the former Baroda State. This article gives a short account of the work done under this scheme during a period of six years from 1943-44 to 1948-49.

Scope of work

The work was carried out at the two main Agricultural Experimental Stations in Baroda namely, Baroda and Jagudan (Mehasana District), and at three other substations. The crops studied were *tur* (*Cajanus indicus*), *moth* (*Phaseolus aconitifolius*), *guar* (*Cyamopsis psoralioides*) and *kodra* (*Paspalum scrobiculatum*). These crops occupy a large acreage in this area and are locally important.

A large collection of samples of typical local crops as well as those obtained from other regions was made and grown under observational plots. The samples that proved ill-adapted to the local conditions were discarded, while from the promising material single plant selections were made and grown in the succeeding year in randomized replicated experiments. The results were subjected to statistical analyses, which served as a guide in choosing progenies with superior performance, in comparison with the local seed used as control; and these, after being tried in bulk, finally reached a stage of regular varietal trials. At this time only a few strains, which had survived earlier trials, were left in each of the crops.

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The seasons were on the whole not favourable during the progress of the scheme, as the rainfall was irregular and decreasing from year to year. The work on *tur*, therefore, remained inconclusive but in respect of other crops good results were obtained. The performance of the strains evolved is summarized in Table I.

Useful strains

It will be seen that as a result of only six years of work very useful strains have been evolved in crops like *moth*, *guar* and to some extent in *kodra*. Thus, Baleswar 12 and Medhi 33 are found to be the best selections in *moth*, but the former is definitely better on black soil. On the lighter soil also it appeared better, but Medhi 33 definitely reacted better to low rainfall, and since low rainfall is a characteristic of Mehasana District, the latter is a particularly valuable strain under these conditions. Baleswar 12 gave on average an increased yield of 103 lb. of grain per acre over the local, while the increase was 90 lb. of grain over the local in the case of Medhi 33. In *guar*, the strain Malosan 40 gave on average 75 lb. of more grain per acre over the local. It may be noted that both in *moth* and *guar*, the protein content of the selected strains was in no case less, but in some cases it was slightly more than that of the local crops. In *kodra*, selections Baroda 8 and 15 have on average yielded 302 lb. and 227 lb. of grain per acre more than the local, while Vyara 31 gave an increase of only 40 lb. over the local.

Other pulses and millets

Besides the investigation reported above, work of crop improvement was also undertaken departmentally on some other pulses and millets which deserves a mention here.

TABLE I

Performance of the improved types of moth, guar *and* kodra *at various stations*

Crop and strain	Station	Average yield in lb. per acre		Percentage of increase over local		Protein content of grain (per cent)	Remarks
		Grain	Fodder	Grain	Fodder		
Moth (Phaseolus aconitifolius)							
Baleswar 12	Jagudan (light soil)	673	2,786	35	9	23·98	Bold grain
Medhi 33		643	2,417	29	−5	23·28	do.
Local ..		499	2,556			22·93	
Baleswar 12 ..	Vijapur (black soil)	684	1,801	14	4	23·98	
Medhi 33 ..		439	1,421	−27	−18	25·03	
Local ..		599	1,729				
Baleswar 12 ..	Deodarda (light soil)	403	966	14	5	23·63	
Medhi 33 ..		389	853	10	−7	23·10	
Local ..		353	918			23·63	
Guar (Cymopsis psoralioides)							
Malosan 40 ..	Jagudan	603		10		28·55	White grain
Local ..		546				29·93	
Malosan 40 ..	Vijapur	573		27		29·92	
Local		451				30·98	
Malosan 40 ..	Deodarda	331		16		30·63	
Local ..		286				29·55	
Kodra (Paspalum scrobiculatum)							
Baroda 8 ..	Baroda (light soil)	981	5,683	44	2		Late by a week
Baroda 15 ..		906	8,278	33	48		
Local ..		679	5,584				
Vyara 31 ..	Vyara (black soil)	345	461	13	16		
Local ..		305	395				

Note. All results are average of three-year trials, except for the results for *moth* at Jagudan, which are averages of four years.

Jagudan 44 is a strain evolved in one of the millets, namely *bavto* (*Eleusine coracana*), which proved superior in yield to the local to the extent of 17 per cent on an average. Work on other pulses such as *mung* (*Phaseolus mungo* var. *radiatus*) and *urd* (*Phaseolus mungo*) was started but had to be given up in later stages for want of funds, but the find of an early type of *mung* is worth mentioning. The importance of this type lies in the fact that being early, its seed can be sprinkled in a crop of *bajra* (*Pennisetum typhoideum*) which is to be followed by wheat ; normally this is not possible as the local *mung* crop matures much later than the *bajra* crop. If the early type of *mung* is sown mixed with *bajra*, an additional income can be secured from the pulse, apart from

the favourable effect of the legume on the soil. This may be done without disturbing the rotation of crops locally followed in Mehasana District wherever well irrigation is available. Unfortunately, the seed of this early *mung* type could not be multiplied so far in sufficient quantity in order to translate this possibility into actual practice. Such a work may be undertaken in future with advantage.

The strains described above have been evolved as a result of experiments carried out at experimental stations. In cases in which, as a result of breeding work, more than one strain are found, with yield and other characteristics superior to the local, further choice, for multiplication and distribution, between such strains, or the delimitation of tracts to which these different strains may be confined, becomes a matter of extensive testing under cultivators' conditions. A beginning was made in this direction in the last year of the scheme when the seeds of the promising strains were given for District trials. The results were, however, vitiated due to the famine conditions which extended over the whole of Gujerat in 1948-49. The strains, however, have high yielding potentialities and they are bound to do well over the local in any case. That a thorough search for superior strains was made both in the local as well as material from outside the State will be evident from the fact that in the case of *kodra*, Baroda 8 is isolated from the local crop while Baroda 15 and Vyara 31 have been isolated from materials obtained from Nizamabad (Hyderabad State) and Nagpur respectively. On the other hand, it is interesting to note that a very superior strain of *mung*, with 100 per cent more yield and a uniform bold grain, has been evolved recently in a similar scheme conducted at Ujjain from the material supplied from Baroda. These examples will show how the unselected crop material in any locality is potentially rich, and consists of biotypes which may prove very useful to the locality of their origin or sometimes even to remote ones. Free exchange of material between different tracts is, thus, a step of prime importance in any plant breeding project and this should be done on a more extensive scale than is practised at present.

The strains described in the present article when properly multiplied and distributed will serve an area of about 150,000 acres in Baroda alone. Besides they will be equally good, because of similar soil and climatic conditions, to a large adjoining area of Bombay State. The result will be a large addition to food production and an increase in the income of the cultivator.

The isolation of superior strains in *guar*, *moth*, *kodra* and *bavto*, described in this article, may be considered as an excellent demonstration of the principle that in crops, which have not been subjected to any selection or breeding previously, rapid improvements may be brought about provided a scientific breeding technique is systematically adopted. The present scheme was the first of its kind in the whole of Gujerat and Kathiawar. Besides the pulses and millets on which work was done, there are several other pulses and millets which contribute largely to the dietary of the population in this tract. In veiw of the encouraging results obtained in the present scheme, it is to be hoped that schemes for breeding better yielding varieties will be extended to these other crops.

REBUILDING INDIA'S NATURAL WEALTH

By J. J. CHINOY

IN these days of food scarcity the thoughts naturally turn to mother earth which provides us with our daily bread. We have ravaged it through our ignorance and greed. Many millions of acres of good land have gone out of cultivation on account of sheer neglect. Vast tracts of irrigated land are now soaked in alkali salts due to faulty drainage and bad construction of canals. Our lands are being mercilessly swept by hurricane winds lifting millions of tons of productive soil and not only laying bare the naked raw subsoil of low fertility, but also devastating the crops due to its scorching, withering blast.

Wooded belts

Can we not do something to prevent this collosal frittering away of our natural resources ? Recently the U.S.S.R. launched an unprecedented programme for the remaking of nature over a vast area where collective farm lands alone total some 300 million acres. This plan calls for the prevention of droughts by setting up, by the State, of a system of wooded belts totalling over 3,000 miles in length to act as barrier against the hot dry winds from Central Asia. Fields of 80,000 collective farms are to be protected with shelter belts and the movement of sand is to be prevented over large tracts. Tens of billions of saplings are to be planted and looked after. Ponds and reservoirs totalling 44,000, as well as irrigation canals, are to be dug, and collective farm hydroelectric stations built to irrigate the fields during dry spells. Five hundred and seventy stations with machinery and other mechanical facilities for affecting the afforestation programme are to be set up. The plan is projected to be carried through in 10 to 15 years.

The hot dry winds that blow over the plains of India during summer months not only destroy all vegetation including wild grasses but also cause severe dust storms resulting in the erosion of good soil. A plan on Russian model is the crying need of our country. The free sweep of hot winds can be prevented by cutting up the cultivated areas into rectangles by shelter belts ranging from 30 ft. to 40 ft. in width. Shelter belts can also be constructed along both the sides of canals and rivers. The details regarding the suitable species of trees to be planted, cultivation and care of these trees and the cost can be easily worked out by a committee of experts. A certain proportion of these trees planted in these shelter belts may be fruit bearing trees and shrubs which will augment the food supply of the country.

This afforestation plan can be synchronized with numerous multi-purpose development projects which are under way in different parts of the country. The biggest defence line against the destructive winds should be planted from the north-western end of the Punjab to the borders of Cutch. A number of successive parallel belts at intervals of 500 ft. could be laid out there covering about a mile in depth. These can be supplemented by other protective belts along the rivers and the canals.

Nurseries for saplings

It will be necessary to establish Government nurseries for producing large number of saplings needed for this work. Mechanized methods of tree planting and cultivation will have to be called into service. The most important result of this afforestation plan will be to restore and enhance the fertility of the soil by means of judicious rotations of alternating food and fodder crops. It will also to a considerable extent solve our fuel problem and will also enable the cultivator to conserve the farmyard manure.

While the Indian forests are being rapaciously cut the Soviet Union is steadily engaging in afforestation. The new wooded tracts, scientific cultivation of the soil, the

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use of farm machinery and other methods are creating new natural conditions in zones hitherto subject to drought and erosion. With the expansion of the green areas, the climate becomes more moderate and humid and within a brief space of time grain and fodder yields increase. Recently it has been shown that grain development in wheat is adversely affected by high temperature and low humidity as a consequence of which low yields are obtained[1].

In conclusion we may add that our Prime Minister has rightly stressed the seriousness of our food problem and placed it on a war footing. Finances for this war-effort must be found. Drought is a common feature of our agriculture and if we can emulate the example of U.S.S.R. even to a limited extent, we will be able to transform bleak eroded tracts into smiling fields, and may be able to keep the demon of drought away from our lands by changing nature.

I wish to thank Mr. V. Shibayev, Head of the Department of Russian, University of Delhi, Delhi, for supplying me with information regarding the Soviet Afforestation Plan.

[1] J. J. Chinoy (1947). *Nature* **159** : 442.

PRESIDENT'S MESSAGE TO PALM *GUR* WORKERS' CONFERENCE

THE President, Dr Rajendra Prasad, sent the following message to the All-India Palm *Gur* Workers' Conference which was held in Najibabad, Uttar Pradesh, from March 12 to March 15, 1950.

'It has been amply established by experiments that *Tar Gur* is superior in nutritive value to ordinary refined sugar. The attention of the people to this matter had originally been drawn by Gandhiji. I am confident that your persistent efforts would evoke the interest of the people all the more towards the utility of this product, and they would begin to make good use of this national wealth.

I would, therefore, urge the Palm *Gur* workers not to relax their efforts as the work they have undertaken is of considerable national importance, and would prove of great blessing, particularly to the peasants and workers of this country'. (*P.I.B.*)

What the Scientists are doing

CHEMICAL AND BACTERIOLOGICAL EXAMINATIONS OF MILK IN BOMBAY CITY

THE wholesomeness of milk marketed in big cities in India has become an important subject for investigation on account of certain observations made by Dr Wright, Mr. Pepperall and others regarding its production, distribution and food value. Examination of chemical constituents or of bacterial counts of milk samples collected in certain big cities in India has been carried out in the past. But, it is the first time that a simultaneous examination both of the chemical constituents and bacterial contents of milk sold in the Bombay city has been undertaken. Forty samples of milk—15 drawn from buffalo stables and 25 from milk vendors—were subjected to examination. The following is a brief summary of the results obtained :

1. Milk from buffalo stables served to regular customers either direct or through the Government-subsidized milk shops has been found to be the best and to conform to the average quality of buffalo milk except in water content of about 50 per cent of the samples. But the vendors' milk has been found to be heavily adulterated with water.

2. The average standard plate counts of bacterial colonies in buffalo stable's milk and in vendors' milk were 1,475,533 and 1,368,800 per c.c. respectively.

3. In accordance with the plate counts of bacterial colonies per c.c., the classification of the milk samples examined as well as the proportion indicated by each class are given below :

Class I or good milk ..	32 per cent
Class II or milk of fair average quality ..	60 per cent
Class III or bad milk ..	8 per cent
Class IV or very bad milk	..

4. The bacterial plate count of the milk samples, which were rich in fat and total solids, was slightly higher than in those which were poor in food value and which contained a large percentage of water due to adulteration.

5. Whey of two out of 40 samples of milk examined exhibited a doubtful agglutination reaction against the antigen of *Brucella abortus*, the causal agent of contagious bovine abortion in cattle.

6. All milk samples of buffalo stables and 80 per cent of vendors' milk samples were found contaminated with *B. coli*. The presence of this organism renders milk objectionable for consumption in a raw condition.—(R.N.N.).

You ask We answer

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in States. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

DEVELOPMENT OF MEDICINAL PLANTS IN INDIA

Q. What steps are being taken for the development of medicinal plants in India ?

A. In the previous meetings of the Medicinal Plants Committee of the Indian Council of Agricultural Research, it was brought out by the representatives of the Indian chemical industry that they felt a scarcity of many drugs owing to their restricted imports from abroad. As many of the plants yielding these drugs could be cultivated successfully in India, it was decided that a list of important medicinal plants, prepared on the basis of the demand for various drugs by the industry, should be drawn up by a special sub-committee. Accordingly a list of 46 medicinal plants was finally drawn up and these were selected for cultivation in six regions into which the country was divided for this purpose. In four of the six regions two centres were selected, one to represent the plains and the other to represent higher altitudes ; these are indicated by (i) and (ii) respectively in the list of regions given below. In the remaining two regions (No. 1 and 5 of the list) trials were to be confined to the higher altitudes only.

1. Himachal Pradesh : Simla Hills
2. Punjab : (i) Gurdaspur and (ii) Mannali
3. Madras : (i) Coimbatore and (ii) Nilgiris
4. Bombay : (i) Poona and (ii) Panchgani
5. West Bengal : Darjeeling
6. Assam : (i) Jorhat and (ii) Shillong

Out of the 46 medicinal plants selected, those that happen to be either shrubs or trees would be entrusted to the Forest Department of the region concerned, while the annual plants would be taken up by the State Departments of Agriculture.

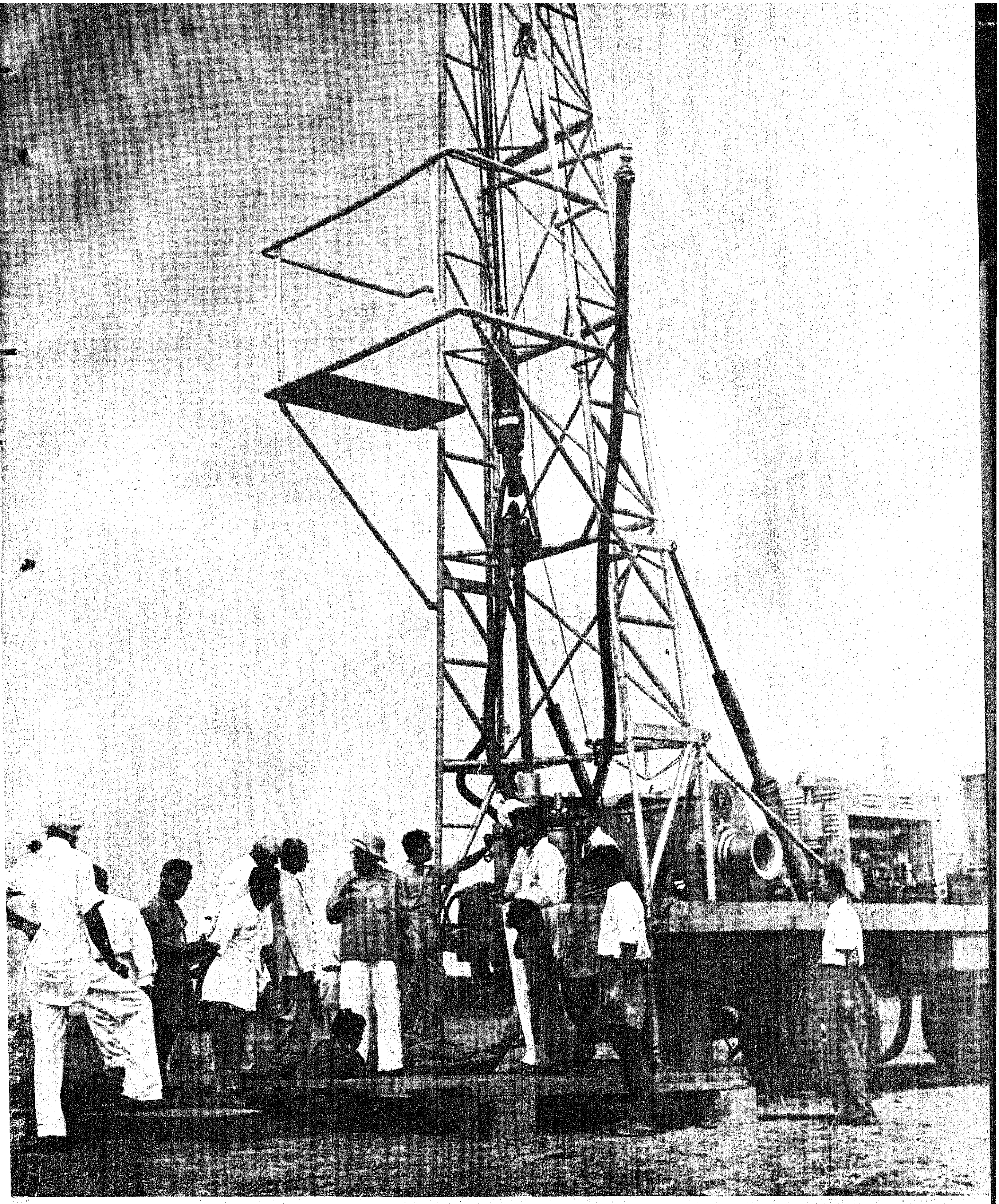
A coordinated scheme of research on the plants selected for the various centres was also drawn up with the following objects in view :

(1) To evolve improved methods of cultivation, collection storage and marketing of the crude drugs,

(2) Trials of the cultivation of the various species of medicinal plants with a view to discover which climatic and edaphic conditions would give the maximum quantity of the active principle contained in each medicinal plant, and

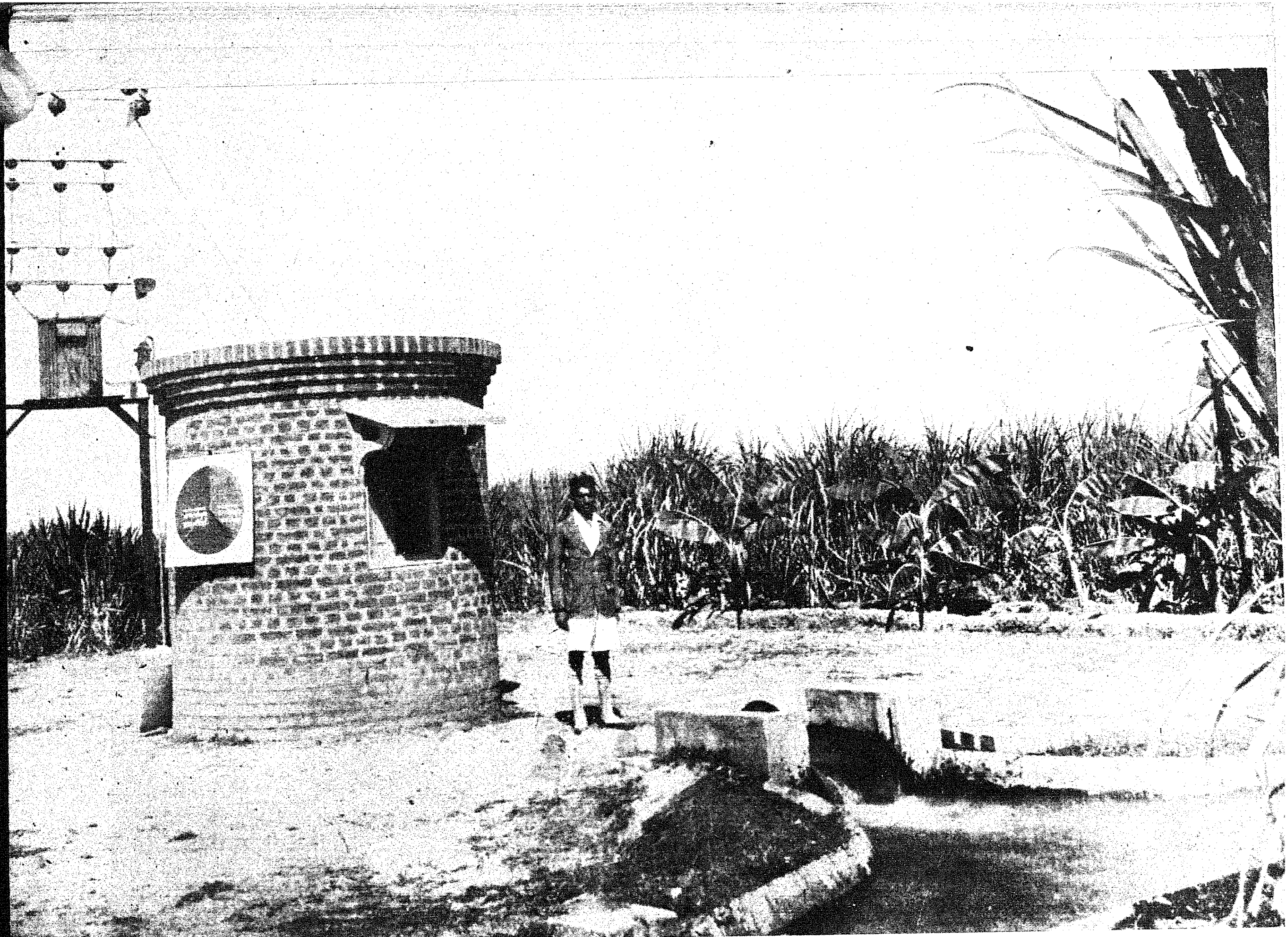
(3) Selection of better varieties and determination of suitable developmental stage of each species for the collection of the drug as determined by the presence of the active principle.

These objects are sought to be achieved by the botanist and the chemist working in collaboration with each other. After sufficient knowledge on the points enumerated above has been gained, it will be possible to encourage large-scale cultivation of such medicinal plants for the manufacture of drugs on a commercial scale. In addition to attaining self-sufficiency in these drugs, such a step would also be conducive to building up surplus stock for export.—(R.S.).



Sub-soil water has been struck on the top of the Delhi Ridge near Chitarpur village. Tube-wells at Chitarpur village

PLATE 41

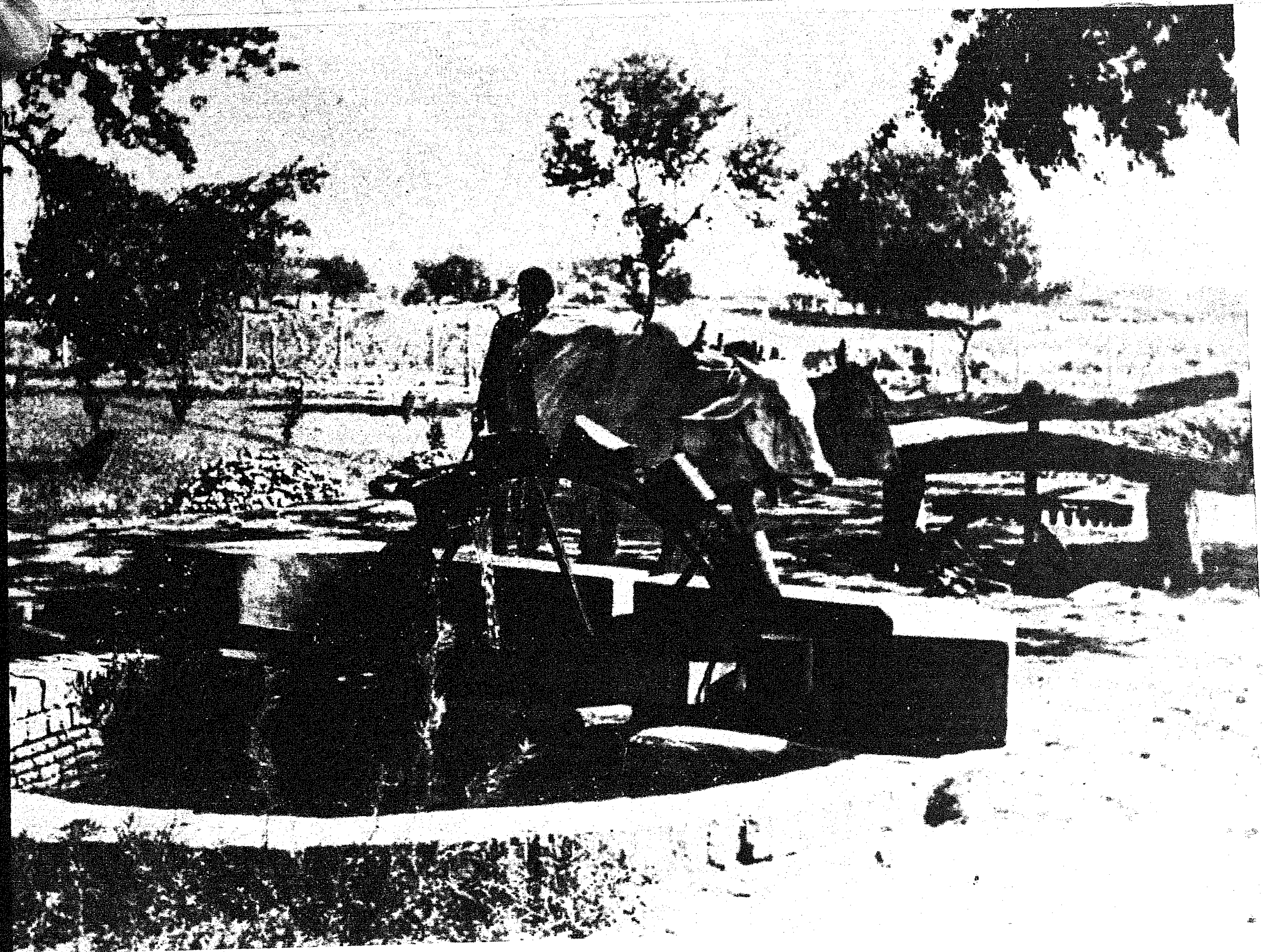


A tube-well with the measuring tank and a rural type transformer in Uttar Pradesh

PLATE 42

Oxen drawing water from well for irrigation purposes. As the oxen run down the slope, the bucket comes to the surface and the water pours into the small irrigation channel

PLATE 43



A Persian wheel being worked by bullocks

PLATE 44

What's doing in All-India

FOOD PRODUCTION AND MINOR IRRIGATION WORKS

BETTER seeds, more manure and scientific methods of cultivation play their part in increasing crop yield but without adequate and timely supply of water these cannot produce effective results. In any schemes for increasing food production, therefore, the provision for irrigation facilities is of prime importance.

India leads the world in irrigation and despite the fact that a large part of the best irrigated area has been lost to India as a result of partition, India still has about 47 million acres of irrigated land. Of this acreage about 17 millions are irrigated by canals and the rest by surface percolation wells, tanks, tubewells, etc. But this area, though considerable, represents only about one-fifth of the total area under crops; the need for extension of irrigation facilities is thus imperative, to avoid dependence on rainfall which is at times fitful.

The multi-purpose irrigation projects undertaken by the Government of India will no doubt add considerably to the food production of the country but their completion will take time. The requirements of the food self-sufficiency plan, however, which aims at stoppage of imports by 1951, make it essential that there should be an immediate increase in the area under irrigation. The present plan, therefore, places greater emphasis on the quicker and simpler means of increasing irrigation facilities by the construction and repair of surface wells and tanks.

Surface wells

The number of wells constructed between 1943 and 1947—the first phase of the 'grow more food' campaign—was 71,844. During 1947-48 and 1948-49, new wells sunk numbered 25,920 and 33,553 respectively. For construction of wells, elaborate equipment as in the case of tubewells is not necessary and the expenditure involved is within the means of small farmers. On an average, a well can irrigate about five acres of land yielding roughly an extra ton of produce. Irrigation by surface wells has, however, a disadvantage compared to canal irrigation. Water from surface wells has no fertilizing property, whereas canal water carries a fertilizing silt and distributes it in the irrigated fields. To obtain the maximum benefit out of well water, application of manure to a considerable extent is, therefore, necessary.

Lifting of water from wells is done by various means in different parts of the country. Beside lifting by hand or animal power, electrically driven engines are used in certain parts of the country, while in others a Persian Wheel is the common means. The Central Government has recently recommended to the States an improved type of Persian Wheel which is likely to effect considerable saving in bullock-power. In Western and Southern India, a *moat* consisting of a leather sack secured by means of a rope is the usual means of lifting water.

Tanks

Another useful source of irrigation is tanks. Many such tanks exist throughout the country, especially in South India, which store rain water of the surrounding areas and can be used during the dry season. These tanks, however, require constant attention as they are likely to be silted with the soil washed down by the rain water. Unfortunately, not enough attention has been paid in the past to the renovation and excavation of these tanks.

Renovation of these tanks has been undertaken as a part of the 'grow more food' campaign and the Government of India are subsidizing State Governments

by sharing half of the uneconomic part of the expenditure involved.

Tubewells

Tubewells are another important source of irrigation in areas where subsoil water in large quantities exists. At present, State-owned tubewells with capacity of $1\frac{1}{2}$ cu-sec. equivalent to 33,000 gallons of water per hour exist in the Uttar Pradesh and Bihar. The tubewells in the Uttar Pradesh numbering about 2,200, are supplied with electricity from the Ganga Canal Hydro-Electric Grid and each one can irrigate about 400 acres. The cost of each tubewell comes to about Rs. 40,000.

A proposal for the construction of 3,000 more State-owned tubewells in the Uttar Pradesh, Bihar and the Punjab, within the next two years, is under consideration of the Government of India and the State Governments.

Food irrigation

Other methods of irrigation practised in India are flood irrigation and inundation irrigation. These systems, mostly in vogue in Egypt, consist in diverting the monsoon flood water of a river to surrounding lands. The flood water spreads on the land, soaks it thoroughly and the moisture retained in the soil allows the cultivation of a winter crop which would otherwise not be possible. The flood water being charged heavily with fertilizing silt from the rivers dispenses with the use of manures to a certain extent, and also allows regular annual cropping of the same piece of land without any harmful effect on the soil. (P.I.B.)

UTTAR PRADESH

H. K. LAL

JAUNSAR BAWAR is little known in many parts of the State and perhaps does not exist on the map as far as the people outside the State are concerned. This area in Chakrata tehsil of Dehra Dun district has its own story to tell. Its people and their tradition and customs present an interesting study. The people are backward and poor.

The State Government have therefore sponsored special schemes for the development of this backward area. Recently a Development Exhibition was held at Chakrata. This was a step towards that direction, and in this exhibition various Departments of State Government like Agriculture, Animal Husbandry, Forest, Health, Education, etc. took part.

The cattle, like in many other hilly areas, are poor and undeveloped. There is a considerable population of sheep and goats but they have no special features about them to merit description.

H. K. LAL, B.SC., M.R.C.V.S., is Deputy Director of Animal Husbandry, Uttar Pradesh, Meerut.

Among other activities of the Animal Husbandry Department one was to hold a one-day cattle, sheep and poultry show. It would have been just like any other one-day cattle show but for the attractive background provided by the snow capped peaks of the Himalayas, with their changing panorama, at sunset and sunrise, and the picturesque *sal* trees.

At first it was felt that disappointment was in store, and all the efforts to get the animals from the distant pine-covered villages were bound to fail, but luckily this view proved to be wrong. The villagers came in large numbers, marching with their cattle and sheep and with poultry held in their arms. Some of them traversed as many as 20 miles which is a strenuous job in a hilly area, with its steep climbs and slopes. There were 117 entries in the cattle wing, and the village cattle had to face a tough competition against the well-fed city cows, but even so they managed to get some prizes,

FIG. 1. A local sheep at the show

FIG. 2. Rampur Bushar ram, distributed for sheep improvement

PLATE 45

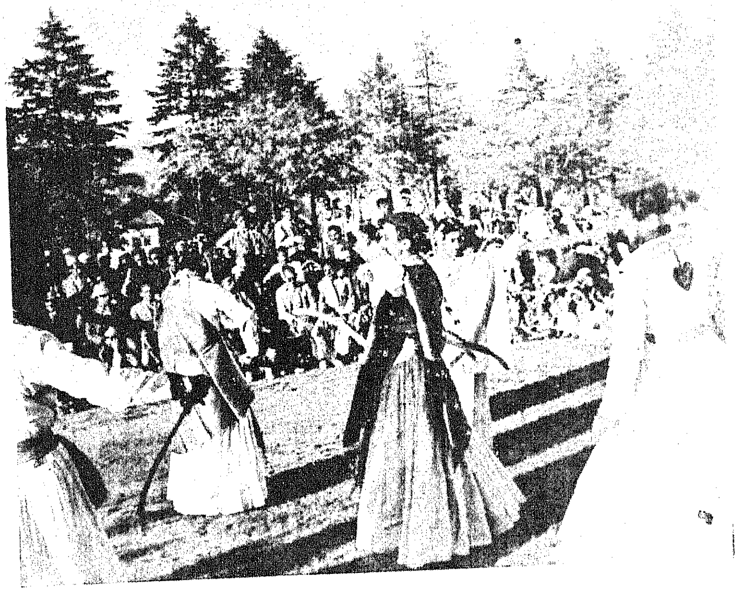


FIG. 3. Dancers with their attractive robes and brandishing swords

well-deserved and well-earned for the trying journeys they undertook.

The Department has recently distributed some Sindhi bulls for the improvement of hill cattle.

Jaunsar area may be termed as a sheep area and Bawar a cattle one. As has been said earlier, there is no special breed of sheep and the sheep brought to the Show, the entries totalling 206, were a mixed lot. The sheep breeder in this area has features that tell the tale of hard work he has to put in in rearing and bringing his sheep to maturity. Most of the wool produced here is consumed locally. Rams from Rampur Bushar area have been distributed by the Animal Husbandry Department in this area to bring about improvement in the quality and quantity of wool. Persistent and concentrated efforts are, however, required to bring about improvement in wool and to make this area self-sufficient in wool.

Nothing more may perhaps be said about the poultry show except that the villager in this area has not yet seriously taken to the breeds like the Rhode Island Red and the White leghorn distributed by the Department. But continuous efforts are bound to succeed sooner or later.

Additional interest was provided by lectures, magic-lantern shows, etc. But the most popular feature was the folk dance by the local inhabitants. The dancers with their attractive garments and brandishing swords appeared picturesque and delighted the audience by display of their art.

PUNJAB

DILBAGH SINGH

THERE is a network of 195 Veterinary Hospitals, 35 Permanent Outlying Dispensaries and about 600 Temporary Outlying Dispensaries in the State. The staff of the department treated 3,41,980 cases in hospitals and dispensaries and at the time of tours performed 72,243 castrations during the quarter under report.

Incidence of contagious diseases

One hundred and four reports of contagious diseases amongst livestock were received and promptly attended to by the subordinate veterinary staff. Out of these, 92 were cases of hæmorrhagic septicæmia, six of foot-and-mouth disease, five of rinderpest and one of cow pox. It is encouraging to note that as a result of large-scale vaccination with Goat Tissue Virus Vaccine, the incidence of rinderpest remained fairly low.

Control of contagious diseases

Table I shows the number of vaccinations and inoculations performed against different contagious diseases during the quarter under report :

TABLE I

Vaccinations and inoculations performed against contagious diseases

Item of work	Number of vaccinations/ inoculations performed
Goat Virus vaccinations ..	2,30,495
Anti-rinderpest inoculations ..	4,703
Anti-hæmorrhagic septicæmia vaccinations	52,625
Anti-hæmorrhagic septicæmia inoculations	6,395
Blackquarter vaccinations ..	1,142
Equine anti-abortion vaccinations	92

Goatis production

The Vaccine Institute, Dagshai (Simla Hills), produced 4,01,200 doses of Goat Tissue Virus Vaccine out of which 3,73,200 doses were issued to the field staff working

DILBAGH SINGH is Personal Assistant to the Director of Veterinary Services, Punjab.

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in the Civil Veterinary Departments of the Punjab, Delhi and Himachal Pradesh.

Livestock breeding

Two hundred and eight pedigree bulls, two donkey stallions, 43 cows, 31 he-goats and 16 Bikaneri rams were issued from the Government Livestock Farm, Hissar, for breeding purposes during the period under report.

Approved cow bulls and buffalo bulls, 6,885 and 2,800 respectively in number, were at work in the State. The staff inspected 2,271 bulls and castrated 485 bulls that were unfit for breeding.

Cattle fairs

Due to the lapse of the Punjab Control of Cattle/Sheep/Goats (Movement) Order of 1949 on 21 December, 1949, inter-State trade in cattle increased and as many as 30 cattle fairs were held at different places in the State. Table II gives the details of some of the important cattle fairs held during the quarter ending 31 December, 1949.

Dairy development work

The Dairy Section of the Government Livestock Farm, Hissar, produced 2,12,441 lb. and 8 oz. of milk, sale proceeds of which amounted to Rs. 35,091 as. 6. The Dairy Development staff visited 398 villages and 495 dairies and milk production centres during the course of their tours in connection with the milk survey of different places. As many as 287 lectures were delivered by them on various aspects of dairy science. The Three Months' Course of Training in Dairying was run at the Government Livestock Farm, Hissar, and seven students received this training.

Gaushalas

The Dairy Development staff visited 46 *gaushalas* in the different districts of the State and gave free technical advice on matters concerning *gaushala* improvement work to the managements of these institutions. The Divisional *Gaushala* Development Boards held their meetings at important centres.

Fisheries

The Department issued 707 licenses for fishing and realized Rs. 3,270 as. 8 as licensing fee during the period under report. Sixty-two cases of illegal fishing were compounded and Rs. 354 as. 14 p. 6 realized as fine. Fish totalling 2,151 maunds 16 seers and 6 chhatak in weight was caught; the income to Government from the sale of fish amounted to Rs. 25,884 as. 12 p. 9.

Poultry husbandry

The Department maintains the Government Poultry Farm at Gurdaspur with three substations at Kangra, Jullundur and Ambala. Eggs 3,564 in number were produced at these poultry farms during the period under report. The income from the sale of eggs and pedigree birds amounted to Rs. 2,634 p. 6. Short courses in poultry husbandry are run at the Government Poultry Farm, Gurdaspur, for the benefit of persons interested in poultry farming.

'Grow more food' campaign

Under the 'increased food production' campaign, two schemes as given below were initiated.

1. Capture and domestication of wild cattle.
2. Stocking with fish a large number of impounded waters in the State.

Veterinary education

The Punjab Veterinary College at Hissar was originally opened by the State Government on 15 February, 1948, on a camp basis for those students who were previously studying at the Punjab Veterinary College, Lahore, and had been displaced on account of partition. From 1 March, 1949, the College was put on a permanent basis. The College is at present housed in a part of the local Government High School building. Practical surgery, shoeing and hospital work are carried out at the Government Livestock Farm Hospital and the Civil Veterinary Hospital, Hissar, which provide ample opportunities for clinical work.

In a short period of about a year and nine months, the College has been well equipped. A library has been organized and

laboratories have been set up. It now compares favourably with other veterinary teaching institutions in the country. Since its opening, two batches comprising 26 students have qualified for and have been awarded the Degree of Bachelor of Veterinary Science of the Punjab University. They have all been absorbed either in the Civil Veterinary Department, Punjab, or elsewhere. In all 33 fresh students have been admitted to the College.

Research and investigational work

Research on various problems relating to livestock was continued under the several schemes jointly financed by the Punjab Government and the Indian Council of Agricultural Research.

TABLE II

Details of some of the important fairs held

Cattle fair	Number of animals that entered the fair grounds	Number of animals sold	Highest price realized				Lowest price realized				Average price				Sale proceeds	Amount distributed as prizes
			Bullock	Cow	Buffalo	Camel	Bullock	Cow	Buffalo	Camel	Bullock	Cow	Buffalo	Camel		
			Rs.		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Cattle Fair, Jahazgarh	35,290	3,518	1,350	..	800	..	100	..	62	..	..	..	..	..	..	311
Cattle Fair, Pataudi, District Gurgaon	31,496	3,847	562	..	522	529	109	..	82	65	248	..	178	293	6,87,311	300
Cattle Fair, Rohtak	25,801	2,784	730	..	525	..	95	..	58	..	..	..	..	..	5,64,622	186
Cattle Fair, Bhakhli, District Rohtak	21,605	2,391	1,100	..	650	900	110	..	45	250	..	..	..	..	..	280
Cattle Fair, Dabina, District Gurgaon	1,970	341	520	..	600	587	182	..	30	172	221	..	113	410	..	48
Cattle Fair, Tarn Taran, District Amritsar	5,510	..	..	..	..	..	..	..	..	..	112	93	134	..	..	405

Home Gleanings

THE ARECANUT INDUSTRY IN INDIA

By K. GOPALAN

THE arecanut has the unique distinction of touching the lives of the people of India belonging to all classes and communities. The chewing of *pan* and *supari* with ancillary spices like clove thrown in is an immemorial and universal habit in this country knowing no barriers of rich and poor. While the chewing of the betel-nut is a source of innocent pleasure to millions in this country, the growing of the tree is a matter of vital economic consequence to hundreds and thousands of families whose chief means of livelihood is the proceeds of the yield of the arecanut palms they cultivate in their scanty plots of land.

In India the areca palm is cultivated all along the Western Coast from Bombay to Travancore, on the plateau of Mysore, in the Gangetic Delta of Bengal and in Assam. The plant requires plenty of moisture in the soil throughout the year and can, therefore, be grown only in areas of heavy rainfall or where abundant irrigation facilities are available. A cool and somewhat moist atmosphere is essential for its growth and for that reason shady trees like coconut, mango and jack are generally found interspersed in areca plantations. In some areas arecanut is probably the principal cash-crop of the locality from the proceeds of which the people purchase their daily needs. Being, however, a highly localized crop, its influence on the general economic structure of the people is small and as such the industry and its problems have so far been taken for granted and have not received the attention they deserve.

K. GOPALAN, M.A., B. COM. (Manchr.), is Secretary of the Indian Central Coconut Committee. He was also Secretary of the *ad hoc* Arecanut Committee.

Area and yield statistics

The statistics of the area and production of arecanut are far from satisfactory and they are not being maintained in some of the important arecanut producing provinces and States like Travancore, Cochin, West Bengal and Assam. Only in the Madras province and Mysore State are they being collected and published regularly. The Revenue Department, Bombay province, also maintains the figures of area under arecanut. The data for other areas, therefore, have to be estimated and are by their very nature highly conjectural, thanks to the absence of reliable statistics and the mixed nature of the arecanut plantations. On the basis of the enquiries made by the Central Marketing staff it has been possible to get the following figures of the area under, and production of, arecanuts in the different provinces and States in India for 1944-45:

Province or State		Area in acres	Production in lakh maunds
Madras	..	107,000	7·70
Travancore	..	40,000	2·72
Mysore	..	37,100	2·77
Cochin	..	24,400	1·99
Assam	..	23,500	2·85
Bombay	..	19,400	2·91
West Bengal	..	3,500	3·50
Coorg	..	800	1·20
Others	..	2,000	1·20
Total	..	257,700	26·84

India a deficit country

India is a deficit country with regard to arecanuts and has to import large quantities

chiefly from the Strait Settlements, Ceylon, Pakistan, Java and Sumatra, to meet the difference between the demand and the supply. The total imports of arecanuts in undivided India in the triennium ending 1938-39 averaged about 22 lakhs of maunds. Of this quantity, about 90 per cent was obtained from the Strait Settlements and the rest chiefly from Ceylon. Although sufficient data are not available now to show how much of the net supply of nuts available was consumed in the territory now included in Pakistan, it may roughly be taken as about 17 lakhs of maunds. It may be estimated that about 51 lakhs of maunds of arecanut are consumed in the Indian Dominion as against a total production of 27 lakhs of maunds. The need, therefore, for stepping up the production of arecanut is apparent. One of the chief handicaps in increasing the production, however, is the cheapness of the imports from the Strait Settlements which usually depress the price of the local produce.

Scientific cultivation

The set-up of the arecanut industry in India is such that it has not been possible for it to withstand effectively foreign competition. The cultivation and production of arecanut are mostly in the hands of small growers with small holdings. The arecanut plantations have also suffered in some localities mostly through neglect and the incidence of the *mahali* and other diseases. There is very little reliable information available with regard to the various aspects of arecanut cultivation such as intercultivation, manuring, the different varieties grown in different localities, agronomic practices adopted in different areas, practices with regard to selection of parent trees, seednuts, seedlings, age of planting, harvesting, curing, etc. The Agriculture Departments in the provinces and States have with them some information on the subject gained mostly as a result of some casual enquiries. They have also in the course of their work on other commodities conducted some spraying trials for the control of *mahali* and other diseases and have found that Bordeaux mixture spraying is effective in controlling the disease and preventing nut fall.

About two years ago, however, the Government of India set up an *ad hoc* Arecanut Committee, who had an enquiry conducted into the state of arecanut cultivation in the provinces and States by an Agricultural Officer appointed for the purpose. The report of the Officer has brought together a great deal of useful information regarding current practices concerning arecanut cultivation in the various parts of the country. The Indian Central Arecanut Committee, which has since been inaugurated, has under consideration schemes to set up a Central Research Station to conduct researches into the fundamental aspects of arecanut cultivation and regional stations to investigate cultural and manurial practices of local significance. It may be hoped that as a result of the work done at these stations it would be possible to evolve definite criteria for the selection of mother palms and seednuts, prepare a calendar of agricultural practices for arecanut growers in the various parts of the country and prescribe measures to combat the pests and diseases.

Arecanut diseases

It has been noticed that thousands of acres under arecanuts in Mysore State, South Kanara and North Kanara districts, Malabar, Cochin and Travancore have been affected by the *mahali* or koleroga disease. The Agriculture Departments in the above areas advocate removal and destruction of dead crowns and the affected leaf sheaths as well as spraying with Bordeaux mixture. The mixture is sprayed on to the bunches of tender nuts by means of a spray pump twice a year. The work of spraying the bunches 20 to 30 feet above the ground by a man climbing up the tree during the rainy months is one of the hardest operations of plant protection. This method of controlling the disease is effective to some extent and it is possible to check further damages by encouraging the growers to resort to this preventive measure on an extensive scale. Then there is the Anabe disease which causes slow but sure havoc and destroys the bearing trees. This is a root disease which is found in the gardens of Mysore districts. It is reported that a

successful means of combating the disease is to apply sulphur at the roots of the affected plants. There may, therefore, be need for opening a research station for determining new methods of control of the disease and finding out effective and cheap remedies against the pest. It may also be worthwhile investigating the possibilities of producing a strain of areca palm resistant to koleroga.

Arecanut nurseries

One of the effective ways of helping the growers to step up the production of arecanuts in the country is the distribution of quality seedlings. The importance of selected quality planting material in the case of a perennial tree like the arecanut palm which takes about 10 years to commence bearing and lives up to an age of about 60 years, cannot be over-emphasized. While improvement in the quality of parent trees by botanical means is a long term research problem, there appears to exist scope for early action by selecting palms of outstanding merit in regard to yield and quality of nuts and propagating seedlings from those nuts, making those seedlings available for new plantings at cheap rates. As in the case of coconut, there are no reliable nursery-men who could supply large quantities of reliable arecanut seedlings. There is, therefore, need for establishing a few nurseries under the auspices of a Government organization for the distribution of quality and reliable seedlings.

Curing and drying

The present methods of processing arecanut such as boiling, colouring and curing are defective and call for considerable improvements. The defective methods of curing and drying the nuts are mainly responsible for the low quality of nuts produced. Much can be done to improve the quality of the cured arecanuts and the methods of curing them. There is also lack of adequate knowledge about the most suitable methods of curing. There is, therefore, no gainsaying the fact that considerable improvements in the methods of processing the nuts can be brought about by undertaking researches about the methods of preparing them for the market.

In the arecanut producing areas there are some places in which it is difficult to get clear sunny days for a sufficient length of period to dry the nuts to the finish. It is well known that some of the areca gardens are located in valleys where sunshine is not always available. Most of them are situated in moist areas where considerable difficulty is experienced to dry the nuts uniformly with the result that the moisture content of the nuts in different areas also varies appreciably. Excess of moisture in the dried nuts affects their keeping quality. Most of these drawbacks can be surmounted by devising mechanical driers for reducing them to a uniform standard.

In some of the areas where immature boiled nuts are prepared they have to harvest a portion of the produce during the monsoon when it is difficult to dry the nuts properly. In such cases the nuts are at present dried over open fire with the result that they get a smoky flavour and become very hard due to the uncontrolled heat. This affects not only their quality but also their price. The present wasteful method of using fuel in the crude driers must be put a stop to and improved driers devised. It should be possible to introduce some labour-saving devises for slicing and splitting the nuts and design a suitable machinery for the purpose. Possibly an adjustment in the slicing machine should be able to change the size of the cutting needed for each variety. The boiling of arecanut and the skimming of the juice could also be done easily by suitable decanters. These improvements will not only improve the quality of the processed stuff but also reduce the cost of processing the nut.

Technical problems

As in the case of agricultural researches, there is little or nothing done to find out better technological uses for the by-products of areca. There appears to exist ample scope for the extension of the use of arecanut both for industrial and medicinal purposes. The nut may be used in the preparation of mordants, colours, etc. On the medical side it may serve as vermifuge, carminative, astringent, etc. It may also serve as a harmless colouring matter in the manufacture of lipsticks and facial creams.

At present the husk of the arecanut, the areca leaf and areca sheath are practically wasted although the leaves are used to some extent for thatching houses. The fibre that the arecanut husk can yield should make very good material for stuffing mattresses. It may also be useful in the manufacture of gunny bags, canvas, shaving brushes, etc. Reseraches on the utilization of these by-products may yield very good results and it should be possible to make massonite board, craft paper, cardboards and other suitable articles from them. The leaf sheaths and flower sheaths are very good material for packing and may replace the use of cardboard with advantage for various purpose. The leaf sheath has a strong matty body, well built, better built than the cardboard. It is lined with a thin tissue paper-like material that runs with cross-wise fibres which makes it very clean and useful for packing dairy produce, food, etc. The flower sheath may also make good packing material for small quantities of butter, cream, etc. High grade tea which gradually loses its aroma when packed in paper, may not lose it if packed in arecanut leaf sheaths. The leaf and flower sheath may also be useful in the preparation of cases for packing cigarettes. The leaf sheath may also serve as the basic material for making hats.

The stem of the areca palm will make good sporting materials like wickets, handles of rackets, walking sticks, etc. There is no doubt that the producer's returns from the arecanut palm would increase substantially by finding better uses for arecanut and arecanut products.

Economic and marketing aspects

On the economic and marketing sides also there is scope for considerable improvements. As has been indicated above there is considerable import of foreign nuts into the country to bridge the gulf that exists at present between the production and demand. As in the case of coconut, the cheap imports of arecanuts have always resulted in depressing the price of the local produce. It is understood that the cost of production of arecanut in countries like the Strait Settlements, Ceylon, Pakistan, etc. where it is grown almost wild, is much lower than that in India where considerable attention and effort have to be devoted to its cultivation.

It may easily be conceded that the interest that the growers take in their plantations depends to a considerable extent on the price of their produce. Hence any attempt to enthuse the growers to increase their production of arecanut is bound to be infructuous unless steps are taken to see that the price of the local produce is maintained at a fair level. It would be difficult to achieve this object in the face of the competition that the local nuts have to meet against cheap imports, unless steps are taken to regulate the quantity and price of the imported nuts. It should be possible to regulate the quantity and price of foreign nuts by setting up a commerical corporation. That body could determine the quantity of arecanuts imported from different countries, arrange for the importation of the necessary quantity and fix prices at which different qualities of imported nuts would be sold at different ports having due regard to the prices at which production in the Dominion of India would be a profitable proposition. The Corporation could prepare a quarterly programme of imports through normal trade channel by a system of inviting tenders on condition that the imported stuff would be sold at a price fixed by it. The excess of the selling price over and above the rate at which the importer was allowed to import would provide funds for improving and developing the arecanut industry in the country.

Cooperative marketing

Marketing enquiries have shown that the marketing of arecanut in India is very defective and has not received the attention it deserves. Most of the arecanut growers are small scale cultivators who have been indifferent to the improvement of the industry. Some of them sell their produce to village merchants who advance money to them long before the crop is harvested. It is only the fairly well-to-do growers and village merchants who process the nuts and sell them in the local markets. Because of the existence of a long chain of wholesale dealers and middlemen in the assembling and distributing markets, the growers

generally do not get a fair price for their produce. It should be possible to overcome many of the defects in the present system of marketing of arecanut by organizing a number of cooperative arecanut sale societies. The four cooperative arecanut marketing societies operating at Mangalore in South Kanara, Vattamkulam in Malabar district, Sirsi (North Kanara district) and Shimoga (Mysore) have shown that they do considerable service to the producers and get better prices for the members by pooling their resources and eliminating many of the intermediaries in the trade. These societies, however, handle only a negligible proportion of the crop at present. There is considerable scope for expanding their activities and organizing similar societies in centres where they do not exist at present. The present system of advancing loans on the produce stored under their control benefits mostly the better class of producers. Arrangements should also be made for advancing loans to the growers against the standing crop so that they may be removed completely from the clutches of the money-lenders. There is, therefore, considerable scope for the establishment of a long chain of what may be called cooperative credit-cum-sale societies.

Grading

The arecanut is marketed at present without being properly graded. Even where they are sorted out according to the different qualities the practice is confined to merchants operating in the assembling markets. The classifications adopted by them are not based on scientific principles as a result of which the specifications are unprecise and variable from merchant to merchant. Consequently the number of grades in vogue in the trade at present are too many introduced apparently to the advantage of the merchants and their agents and to the disadvantage of the producers. It is, therefore, clear that there is urgent need for improving not only the quality of the produce but also the method of classification so that the producers can get prices for their produce commensurate with its quality.

Considerable improvements on the marketing side could also be effected by taking steps to organize regulated markets at a number of important centres. All the markets for arecanuts in the country are unregulated and the growers are subject to a number of market charges and deductions in cash and kind which are not clearly defined and specified. Besides, the weights used in the markets vary from place to place as a result of which price quotation on a uniform basis is almost difficult. Considerable headway in improving the marketing conditions could be made by establishing regulated markets in a number of important assembling markets like Mangalore, Palghat, Trichur, Palai, etc. where the market charges could be clearly specified and trade practices controlled by market committees fully representative of all the interests concerned including the producers. In the case of other agricultural commodities like cotton, tobacco, groundnut, etc. regulated markets have helped the producers to get better returns for their produce.

Summary

In the above paragraphs attention has been invited only to some of the more important problems facing the industry. Attention of the Central Government has already been drawn to some of these problems. In 1945, representations were made to the Government of India about the deplorable plight of the industry, the heavy cost of cultivation and lack of adequate returns mainly due to the absence of scientific investigations to improve cultivation and augment production, the ravages worked by the *mahali* disease and the competition by the import of cheap nuts from foreign countries. The Government of India, therefore, set up an *ad hoc* Arecanut Committee consisting of the representative of the Government of India and the Directors of Agriculture of the concerned provinces and States. The *ad hoc* Committee met twice and recommended the setting up of a Central Arecanut Committee for the improvement and development of the production and marketing of arecanuts and arecanut products. The recommendation was accepted by the Government of India and the Indian Central Arecanut Committee was inaugurated on 19 September, 1949.

In a message to the inaugural meeting of the Indian Central Arecanut Committee the Hon'ble Sri Jairamdas Daulatram observed as follows :

'The primary problem for this Committee will be to devise ways and means of increasing the local production and cut out imports as far as possible. I am aware that conditions in the arecanut industry are none too favourable for the objectives to be achieved easily. There has been so far no worthwhile scientific researches in regard to arecanut cultivation, with the result that the grower, following traditional cultivation practices, has not been able to get from his trees returns commensurate with the cost he has had to incur on them. Diseases such as *mahali* have taken heavy toll of the yield of his gardens and he has been a helpless witness of the destruction wrought by them. And even as regards what he actually produced he has not been able to dispose of it to the best advantage, thanks to the array of middlemen who have stood between the growers and the ultimate consumers pocketing a considerable proportion of the profit which legitimately ought to go to the growers. In such circumstances competition from abroad has proved almost the last straw on the camel's back.

'As I see it, therefore, the manner in which the development of the arecanut industry should be tackled would be first to assure to the grower a fair price for his produce by arranging for the cooperative marketing of the stuff and regulating imports so as not to depress the price of the local produce. Having assured this the grower will have to discharge his duty by adopting better methods of cultivation so that production is stepped up and the price is stabilized at a reasonable level.'

One may feel certain that the efforts of the Committee will bring about the fruition of the hopes expressed by the Hon'ble Minister. (*Indian Coconut Journal* October-December, 1949).

UTILIZATION OF BARKS OF TREES

UTILIZATION of barks of trees for producing hard boards is being experimented upon in the Forest Research Institute, Dehra Dun and the details of research so far undertaken are given in a pamphlet (I.F. Leaflet No. 118) just published.

Barks which constitute between six to nine per cent of the total weight of logs in most of the trees are, at present, usually wasted. The Leaflet indicates the experiments undertaken on the utilization of *sal* and eucalyptus barks for making boards and observes that the trials have yielded satisfactory results. (*P.I.B.*)

SAVING FOOD LOSSES THROUGH HEALTHY LIVESTOCK

By S. GORDON COLLER

MILLIONS of tons of food are lost throughout the world every year owing to the scourge of animal diseases, according to Lord Boyd-Orr, famous British nutrition expert and former Director-General of the United Nations Food and Agriculture Organization. And this estimate refers only to losses which could be prevented if up-to-the-minute veterinary and precautionary measures were available to farmers in all food-producing countries equally.

Practical proof of this assertion has just come from London where the British Ministry of Agriculture (Animal Health Division) has published a report on the fight against animal disease in Great Britain over the 10-year period from 1938 to 1947 (inclusive). Because it covers a full decade, the report puts the results attained against diseases which often fluctuate from year to year in their proper perspective, thus enabling them to be judged without bias.

World-wide importance

Although Britain's livestock population is among the healthiest in the world—thanks to the rapid application of scientific advances—the annual loss of food through disease is still put at well over £50 million worth, two-thirds of which is due to cattle diseases. Stakes to be won in the fight against this loss include, it is estimated, an additional 200 million gallons of milk annually, full meat rations for one year for 6,000,000 people, 40,000 tons of poultry meat, and 500 million eggs. The results achieved are, therefore, not only of great scientific importance to other countries but will have a direct bearing on Britain's food imports and her balance of payments.

Of the livestock diseases, the farmer's greatest enemy is 'foot and mouth', probably the most contagious disease known to either human or animal medicine. Official statistics for Europe record 232,504 outbreaks of this disease in Poland alone before the war (in 1938), 218,295 in France, 112,886 in Holland, 94,155 in Denmark, and over 10,000 in Germany, Belgium, Austria, Switzerland and Rumania.

In the same year Britain recorded only 190 outbreaks. The reason is that the disease has never been endemic in Britain. Moreover, by the introduction of central processing (sterilization) of kitchen waste fed to animals, a strict control over the disease has been maintained.

Tuberculosis-free herds

Where tuberculosis is concerned, the report records an immense expansion in the number of herds certified to be free from this disease : from 1,450 approximately in 1937 to over 30,400 in 1947. At the end of 1947 these herds comprised about one-seventh of Britain's cattle population and the proportion is steadily rising. In March 1939 there were over 38,300 attested herds containing over 1,500,000 cattle.

The pig-farmer's greatest enemy in Britain is swine fever, a disease which has also caused ravages in other European countries, such as Switzerland and Czechoslovakia. The number of outbreaks in Britain rose to a peak of over 5,000 in 1940 when nearly 107,000 animals were lost—nearly three per cent of the entire pig population. Since then Britain has virtually conquered this dreaded infection. In 1947, only 824 animals were lost—only 0·02 per cent of the pig population.

The reduction is attributed largely to a decrease in the raw pig products imported from countries in which the disease is endemic. Indeed, so nearly complete has been the eradication of the disease that a highly

successful vaccine crystal violet developed by British research scientists has scarely been required.

Sheep scab

Another disease which has long been prevalent in Britain and is now being gradually eliminated is sheep scab. In 1938, there were 222 outbreaks of this disease in 42 countries; in 1946 the 94 outbreaks recorded affected only 11 countries. Twenty years ago 70 countries were affected and the annual outbreaks numbered about 700. This reduction has been achieved by clearing up pockets of infection as systematically as is done in a military operation with the result that the disease has been completely eradicated from Scotland and confined to a much smaller area of England and Wales.

Scientists have made an important contribution to the conquest of sheep scab by developing a new sheep-dip containing benzene hexachloride. Before the discovery of this dip, it had been necessary to dip affected sheep twice to kill mites which hatched out after the first dipping, but the new dip remains effective in sheep's fleece for so long that it fulfils both the functions with a single application.

In 1947, Britain experienced the only severe epidemic of fowl pest in her history, poultry farmers notifying over 2,200 outbreaks of the disease. The cause is attributed almost certainly to birds imported from Europe, and action was immediately taken to secure the boiling of waste foodstuffs and the application of preventive measures by Britain's overseas suppliers. In this way the outbreak was overcome and the report records that British poultry farmers have remained virtually unaffected by this dangerous disease since then.

Many other animal diseases have been successfully combated during the 10 years the report covers. Anthrax outbreaks in 1946 were the lowest in number for 50 years and parasitic mange, over 5,000 outbreaks of which were recorded among horses 30 years ago, caused only a single outbreak in 1947. The result has been not only a general improvement in the health of Britain's livestock population and consequent increase in food production but also a notable improvement in the quality of British livestock exported to almost every country in the world. In this field the report shows that 75 per cent more animals were exported in 1947 than were sent overseas 10 years earlier. (*B.I.S.*)

Book Reviews

TOWARDS FREEDOM FROM WANT

By D. SPENCER HATCH (Oxford University Press, Bombay, 1949, pp. 303, Rs. 8 as. 8).

THE publishers in their cover slip inform readers that the book 'is a personal account of the successful technique initiated for Rural Reconstruction in several parts of India and particularly at Martandam Centre in the former Travancore State'.

'With slight variations the first twenty-five chapters of this book are mainly reprints of *Up From Poverty in Rural India* (4th ed. 1938) and *Further Upward in Rural India* (1938). Chapter XXVI is a record of Dr Spencer Hatch's experiences in Mexico.'

This book, therefore, is virtually a new edition of the author's previous book which has run through four editions, with a chapter on Mexico (12 pages) added as new material.

Dr Hatch is a powerful writer. He pours out his heart into what he writes and the reader soars with him, viewing the imagery presented. That accounts for the great success of his book which, with the present one is running its fifth edition on the subject of rural reconstruction.

The earlier editions as well as the present one sketch out the programme and describe the setting and also indicate how the rural problems are going to be tackled by demonstration and by training of workers. The place selected for experiment is Martandam in Travancore and is some distance away from Trivandrum, the capital of Travancore, but is connected by a good road. There the experiments were begun by earlier missionaries till Dr Hatch took up the work (as is found from other sources) in 1924.

Twenty-five years have passed since Dr Hatch had taken up the Martandam village uplift centre to serve as a model for training and for projecting his ideas of development in the 42 villages which come within the five-mile circle of the centre.

Dr Hatch has given a description of the population in that area, a considerable number of whom are Christians and, therefore, more amenable to fall in with a planned programme of uplift work carried on by a Christian organization for their welfare, with the help of men and funds brought from outside.

The difficulty that a person reviewing the present volume feels is that while the book is full of the first glow of discovery and initiation, little is said systematically of the changes that have been worked out there after all these years of strenuous effort amongst the people. All imaginable resources had been pooled and brought to bear on the population in a planned way by demonstration, by lectures, by projection of voluntary workers and students in the field. But the reader cannot satisfy his hunger as to the effect of the attempts on the field of work.

Like Dr Hatch many social workers have been working in India for identical objectives from a long time past. The objectives are the moral and material uplift of the villagers. Dr Hatch claims that he has discovered a new approach. Even then it is essential to analyse, if the approach is really new as it is claimed to be, whether it is yielding better results than those of other organizations like the Gandhian Institution, the Shri Niketan, various social service units, the A.I.W.C. and Rural Welfare and Cooperative Departments of the State and Central Governments, who have been also working in the same field.

The case of introducing better poultry keeping may be taken up as a point for illustration. In the present book, Dr Hatch has a Chapter on the Evolution of the Jungle Fowl (Chapter XIX). He traces Indian blood in all breeds of domesticated fowls over the world and regrets that whereas in other countries the domestic Indian fowl has given wonderful results, in India, the domesticated ones are little better than their jungle counterparts in egg-laying

capacity. But he writes, 'I have brought back this improved type and said that they shall be available to every man or woman, boy or girl, even the very poorest.' It cannot be ascertained from the book when he first brought the improved fowls there. But it may have been about the starting period of his activities.

In the Chapter on 'Two Methods' of demonstration and cooperation (p. 41), Dr Hatch says, 'Distribution of eggs in India becomes increasingly important as production is stimulated........With this object before me, I went to China to study the system by which country eggs are collected in great numbers from the villages by agents of large foreign firms. The China eggs undersold the local ones in America.'

'An interesting additional finding was that shipments of Chinese egg-powder were being made to Calcutta. There is no reason why rural India cannot supply Calcutta and our other cities with sufficient fresh eggs........To the supplying of fresh eggs, we and our village friends are in an increasing measure giving attention.'

Later on in Chapter XIX on Jungle Fowl, it is found that this Chapter has been written far in point of time after the above statement. Here, it is indicated that by 1935 the area was fully advanced as far as advancement could be made by one organization with the help of the local cooperative society for the purpose.

'My feeling is that the primary purpose of Institutions like ours is experimentation and demonstration. We have experimented and demonstrated both how to improve the poultry and how to sell the eggs.' (p.203).

'While we have almost reached our marketing limit, I believe that the Marketing Department of the Government of India can arrange for the extra sales.'

It appears that by 1935 the work of demonstration and cooperative uplift as regards egg production was completed in this circle of centres. Thirteen years (1935 to 1948) have flown by, and now this new book has appeared in the present form. One would have expected to know how the villagers have responded to this new venture after a demonstration completed in 1935. This is the crux of the thing—the matter of the social workers' effort and the reaction on the villagers in practical form in the continued success and spread of cooperative ventures.

The book describes reconstructional activities at different stages and at random and stops short after raising great expectations. How are the expectations being fulfilled by continued work? The reply to this is not found in this book.

The secretary of the uplift work described in the book in a report of his, presented to the General Board of Y.M.C.A. for work during 1938-1947, raises this question pointedly:

'In spite of all this service, however, our Rural Secretaries are frequently asked such questions as the following: After 22 years of work at Martandam what have your Y.M.C.A. Rural Secretaries really achieved? How far has your work at Martandam been copied by others? How many villagers have you helped to increase their earning capacity and to what extent? Are results really commensurate with the amount of money that has been spent on this work, year after year?'

The Senior Secretary of Martandam after raising the above questions proceeds to describe the achievements. All that I can say is that the achievements indicated are not commensurate with the expectations raised in the book.

Why with all the resources of the cooperative organization, egg output should be only 700 pieces per day in the group of villages centred round Martandam? Why has it not spread to other areas? These questions are there.

Writing in 1949, Dr Hatch should have brought out the present achievements in the light of the past efforts of 25 years and if the achievements are not such as he had expected, it would be for him to analyse where the obstruction lay. He might have brought in his critical and analytical mind to bear on the present situation and found out why the money and energy spent on students get lost, in a large measure, as in the case of other craft teaching institutions also. I wish Dr Hatch to take up the publication of such a volume as a necessary supplement to the present edition of his book.

Newer truths may then be discovered and

the process undertaken at Martandam modified, if necessary, for wider application. (S. C. DG.)

CATALOGUE OF ECONOMIC AND SOCIAL PROJECTS NO. 1

(United Nations Publication, 1949, $ 2.00. Available from Oxford Book & Stationery Co., Scindia House, New Delhi, India).

THE work of the Secretariat of the United Nations and its many agencies is multifarious and covers a wide range of social and economic life of many nations. It is difficult to keep track of all the information gathered. This *Catalogue of Economic and Social Projects* makes available in a small compass a classified list of the work done with short description of each activity. It is an invaluable book of reference to all students of international affairs. (J.C.K.)

NEW AUSTRALIAN EXPERIMENTS IN RABBIT CONTROL

EXPERIMENTS in rabbit extermination by introducing myxomatosis, a virus disease, are being carried out in Northern Victoria by the Australian Commonwealth Scientific and Industrial Research Organization. Rabbits are Australia's number 1 pest. Some people assert that but for the depredations of rabbits, Australia could increase the numbers of stock animals by millions.

Experiments are designed to test the virus as an alternative to fumigants in wiping out rabbits in a warren. They should also show what chances the virus has of completely exterminating rabbits, reducing them in number, of failing, or making re-infection or new treatment necessary.

Earlier trials showed that the disease would kill rabbits in the warren into which it was introduced but that it would not spread enough on large holdings to cause mass epidemics. It is hoped now, however, that it will save graziers labour in getting rid of the pest. At present, manpower and other shortages are preventing graziers even on high-carrying country, where holdings are relatively small, from adopting control measures that are economically justified.

On such small holdings even an infection which generally remained confined to the warrens into which it had been introduced might prove of some value provided that it wiped out the rabbits with less labour than a fumigant such as chloropicrin.

Site of the first experiment has been selected because it provides an adequate number of well-established warrens conveniently grouped in open, level country, which simplifies the problems of observation and checking. The experiment will probably take two or three months to run its course and the rabbits will be kept under close observation until all signs of the disease have disappeared.—*Australian Agricultural Newsletter.* No. AGN/285.

News and Views

LIGHT AND PLANT GROWTH

PLANTS are affected by light in a number of different ways. First, light acts as a source of energy for building up the substances of which the plants are composed. Without light plant growth is impossible. This function of light is called photosynthesis.

Secondly, light has a bloom-inducing effect. In the case of many plants flowering depends upon the duration of the light per day, regardless of the intensity of the light. Some plants flower only when the day is short (short-day plants), others only when the day is longer than 12 hours (long-day plants) while still other plants flower independently of the duration of the light. This function of light is called photoperiodicity (day-length effect).

Apart from these two functions light influences considerably the shape of the plants. The intensity of the light often determines the size and thickness of the leaves, the length of the leaf stalks and stems, the shade of green of the leaves, etc. This is the formative effect.

In practice all three of these functions of light are sometimes regulated as desired by means of artificial light.

The photosynthetic function requires great intensities of light, since it is a matter of converting luminous energy into chemical energy. Incandescent lamps are not so suitable because with strong light they also give off a great amount of heat, which is apt to scorch any plants close to the lamp. Fluorescent lamps answer the purpose much better.

Where plants are grown exclusively by artificial light only fluorescent lamps can be considered, because these contain all colours of the visible spectrum. This method is already applied on a small scale in the cultivation of tomatoes, cucumbers and some flowers.

To get a long-day effect, low intensities suffice and for this reason ordinary incandescent lamps are usually used, though fluorescent lamps are also quite suitable for this purpose.

In the Netherlands, this day-lengthening is employed on a large scale in the cultivation of winter-flowering begonias. At Aalsmeer several acres of glass houses are artificially lighted for this purpose. The object is not to let the plants flower in the beginning of the winter but only to form plenty of shoots for planting out. When these shoots are planted and exposed to short-day light they soon develop blooms.

Artificial day-lengthening is applied on a smaller scale for other plants, either to force or to check flowering.

In recent times, two practical applications of the formative effect function of light have drawn considerable attention. First, for the forcing of early tulips. Instead of forcing tulips under glass it has been found more advantageous to use heat-insulated sheds or rooms illuminated with artificial lights. The cost of the lamps and electricity proved to be lower than the cost of fuel for heating the glass houses. One incandescent lamp of 75 W per square metre was sufficient for satisfactory development of the tulips.

Another application is for the checking of the sprouting of seed potatoes by means of artificial light. Quite small quantities of light suffice to stop seed potatoes sprouting while in store. This makes it possible to store seed potatoes in cellars illuminated with some fluorescent lamps placed in suitable positions. This method of storage costs much less than storage under glass, and there also seems to be less risk of failure. (Royal Netherlands Embassy, New Delhi).

PIONEER EXPERIMENT IN RURAL DEVELOPMENT

BAWANA, a small village on the Delhi-Meerut Road twenty-two miles from New Delhi, is the centre of activity of a pioneer experiment in rural uplift launched by the Indian Council of Agricultural Research and the Delhi Administration.

Aiming to secure the economic betterment of the rural population, the scheme is concentrated in ten villages. It is in charge of a Rural Development Officer who is assisted by village *panchayats* specially constituted for the purpose. The officer works in collaboration and cooperation with the villagers and the *panchayat* consists of representatives of the ten villages, with its headquarters at Bawana. All important decisions are taken by the *panchayat*. The encouragement of mixed farming, use of improved seeds and implements, application of farmyard manure and compost, improved methods of animal husbandry, and the development of cottage industries like poultry and fishery are among the measures that have been introduced in these villages.

The scheme which was inaugurated in April last year, extends over 14,000 acres of cultivated area, irrigated by the Western Jumna Canal. The irrigated area was selected to ensure that the results of improved methods of cultivation were not vitiated by the lack or inadequacy of water supply. The drive from Badli to Anchandi, a distance of about 12 miles, is the area covered, and includes the villages of Shampur, Sahibabad, Pehladpur, Barwala, Puth Khurd, Sultanpur Diwas, Bawana and Daryapur Kalan.

Badli, the municipal dump of Delhi's refuse, is the first village under the development scheme where can be seen smiling vegetable gardens and fruit orchards grown by owner-cultivators, who have taken advantage of the facilities offered to them. During the current year, nearly 5,000 fruit plants have been distributed to the cultivators.

To irrigate the land, an ingenious method of drawing water from wells has been introduced, which does not need the use of bullock power. The sub-soil water in the area is within 15 ft. of the surface and water can be drawn by using a pulley made out of two tree trucks placed across each other, with a water-pot hanging by a rope from the top of one of the trunks.

Special attention has been paid to the production of cereals. In some fields are sugarcane 8 ft. to 10 ft. high, grown from seeds of Coimbatore variety supplied by the Indian Agricultural Research Institute.

Along with improving agricultural production, steps have been taken to ensure that the cattle wealth of the region, which produces some of the finest Hariana breed, is properly developed. Veterinary staff looks after the cattle and inoculations against rinderpest have been extensive.

Subsidiary village industries like poultry keeping, piggery, and fisheries are being encouraged. To improve the local poultry stock, a large number of Rhode Island Reds and white Leghorns has been supplied to the villagers. Tanks in the area have been stocked with fingerlings and the village people are being taught the economics of fishery.

It will probably take a few more seasons before the final effects of the improvements introduced can be accurately assessed. But the response from the cultivators has so far been enthusiastic and full of promise. (*P.I.B.*)

COVER ILLUSTRATION

Rhododendron arboreum

Sketch By N. S. Bisht.

BOARD OF AGRICULTURE AND ANIMAL HUSBANDRY IN INDIA

CROPS AND SOILS WING

EIGHTH MEETING—PATIALA, MARCH, 1950.

Sitting (*Left to Right*) Dr T. S. Sabnis, S. Kartar Singh, Dr Patwardhan, Shri P. D. Nair, Shri A. K. Menon, Dr Janaki Ammal, Dr J. N. Mukherjee, Shri S. R. Maini, Sardar Datar Singh, Shri R. L. Sethi, Dr H. S. Pruthi, S. Lal Singh, Shri A. C. Malhotra, Prof. J. C. Luthra, Shri J. A. Manawar, Shri J. P. Sinha, Dr P. K. Sen.

Standing (*1st row*) Dr J. C. Ramchandani, Shri S. C. Roy, Prof. L. S. S. Kumar, Shri U. N. Mohanty, Shri E. A. R. Banerjee, Dr E. S. Narayanan, Shri R. D. Bose, Dr B. L. Sethi, Shri Bishan Man Singh, Dr Roy Chaudhury, Dr B. K. Mukherjee, Dr G. C. Sen Gupta, Dr T. J. Mirchandani, Dr K. R. Sontaky, Dr B. S. Kadam, Capt. Dalip Man Singh, Dr M. B. Chandge.

Standing (*2nd row*) Dr R. S. Vasudeva, Dr Sham Singh, K. I. Vidyasagar, Ch. Kartar Singh, Shri Sarvotamrao, Shri P. D. Karunakar, Dr P. K. Bose, Dr Richarya, Shri N. L. Dutt, Shri H. R. Saini, Shri C. L. Bhargava, Shri M. C. Joshi, Shri M. S. Anvikar, S. Swarup Singh, Shri K. C. Chetty, Shri W. B. Sundara Rao, Shri H. G. Patil.

Standing (*3rd row*) Shri M. S. Pawar, Shri M. R. Panikkar, Dr B. C. Kundu, Shri J. Bannerjee, Dr R. Sankaran, Dr V. G. Panse, Dr Arjan Singh, Shri S. M. Sikka, Dr L. A. Ramdas, Shri N. R. Ramiah, Shri V. M. Chavan, S. Amrik Singh, S. Amrik Singh Chima.

PLATE 47.

INDIAN FARMING

JUNE, 1950

Vol. XI No. 6

THE PROBLEM OF FOOD SHORTAGE*

IT gives me great pleasure to welcome you all to Patiala for this conference. I am particularly happy that the Council accepted our invitation to hold this meeting here, as I am confident that we will greatly benefit from the deliberations that you will now hold. I find that not only all States are represented in this gathering, but officers of the Government of India, who are engaged in important research and developmental work on agriculture, and representatives of the cooperative movement, nominees of the Inter-University Board and the Board of Irrigation and other non-officials, have also joined the deliberations. I feel gratified that in tackling what to us at the moment is one of the most important problems, all elements, official and non-official, have joined together, and it denotes that a united effort would be possible which is most likely to yield permanent results.

Gentlemen, the problems that the Council of Agriculture deals with are not temporary. About 85 per cent of the population of our country depends upon agriculture for its livelihood. In the improvement of their standard of living and conditions of work lies the secret of the prosperity of the nation. Indeed on ethical grounds, they deserve well of us, because they are engaged in an avocation which produces food, the sole sustainer of life both human and animal, and the philosophical way in which the farmer goes about his work, must command our respect and admiration. But as I have said just now, the problem has assumed the highest importance, as unless improved methods for growing more food and conserving what is grown are evolved, we are faced with a national danger.

It is a paradox that while no less than 85 per cent of the population is engaged in agriculture, we should not be able to produce enough for everyone to eat. At times this aspect of the case baffles understanding. On rough and simple calculation if every hand employed in the farm were to produce enough for himself and two or three others, who constitute his family, and in addition to that for say one person after every six, there can be no shortage. And surely, whatever the size of the holding, it can produce enough food for six persons for the whole year. So what is the cause of this shortage? I believe, we will have to look for it elsewhere than under-production. I have given the matter some thought, and have come to the conclusion, that it is primarily due to wastage and improper conservation, less yield and possibly also to maldistribution. Imagine, how much food is consumed every year by rats, pests, animals, which could otherwise have been available for human beings. How much more disintegrates owing to defective storage. Still how much more is lost by a very simple piece of negligence in carrying foodgrains from the farmer's store to the market in carts from which it goes on dropping through holes in the bar, and which at its best can only be picked by birds. If arithmetical calculations were made on an organized basis, I am quite sure that the loss through all these will be found to be colossal. Isn't it possible, to take firm steps to remedy these evils. Can we not provide on a cooperative basis proper storages in villages, transport to markets in properly constructed carts, make damp-proof and ant-proof *khatties* in *mandies*, and so on. It should be

*Inaugural address by His Highness the Rajpramukh of PEPSU at the eighth meeting of the Crops and Soils Wing of the Board of Agriculture and Animal Husbandry held at Patiala on 28 March, 1950.

possible to do so, but only the subject does not seem to have received proper attention.

I should not be taken to mean that I do not consider efforts to grow more food necessary. Far from that, I believe that with the growing population of the world and of India as well, it is most essential that agriculture should be placed on an organized basis. We are still carrying on cultivation on primitive methods largely. Here and there farms have sprung up, where machinery is used, but the percentage of acreage under such cultivation is very small. Irrigation facilities are not adequate. Proper manure is not available, and whatever is, is wasted to a very large extent, and burnt as fuel. Apart from the research work in scientific manner, I would invite everyone's attention to lend support to efforts for improvement in these matters. It would be valuable to investigate, what crops could be substituted profitably for the food of the cattle in place of foodgrains. To that extent food for human consumption will be released. Research on high-yielding crops and improved varieties of seed is another direction which can be of very great assistance. Root crops as you know are a very valuable alternative to food crops. Even to this day, these form the staple food of several countries. The yield of tuber crops is greater than foodgrains, and from the point of view of nutrition also they compare favourably with cereals. They are also good fodder, and a source of starch which is useful in industries. They do not require so much care in cultivation, and there are so many varieties that can be cultivated in all sorts of climates and soils. Some are short season crops, while others can be indefinitely multiplied at cheap cost. I know that the Council has undertaken a number of projects for scientific investigation on tubers, and I hope in due course more attention will be paid to this subject.

Apart from the loss of foodgrains as suggested before, even during the actual cultivation period a great deal of loss occurs. Weeds alone are responsible for enormous loss in food crops. In the United Kingdom and the United States of America research has been conducted to control weeds by chemicals. It would be worthwhile for the Council to consider a scheme for carrying out investigation on this subject, and I hope the conference of Entomological and Mycological workers, which has just preceded your meeting, will prove useful for evolving satisfactory solutions to some of these problems.

Another subject which is of paramount importance is the need for extension work. This is probably most important from the practical point of view of the agriculturist. In spite of the improvements, which have been effected in a number of directions as a result of the work of the State Agriculture Departments, and the initiative of the Indian Council of Agricultural Research, the average farmer in this country is probably where he was twenty years ago. Unless the results of research are promptly translated in actual cultivators' practice, all our work in the laboratories and the experimental farms will be sheer waste of effort and money. You are all aware of what other countries have done in this matter, particularly the United States where a very expensive and efficient organization for extension work has been functioning for years past. Our scientists and administrators have had opportunities to study that organization, and I have no doubt that the matter is receiving the attention needed. We have been told of a model venture on a small scale, which the Indian Council of Agricultural Research has undertaken in this direction in a compact group of ten villages near Delhi, and the reports which have appeared regarding this so far indicate that the results are promising. It is a good beginning and is sure to succeed. Let's hope that all our villages will one day be planned on that model. You will be glad to know that under the 'grow more food' campaign, we have also in the Patiala Union taken up a group of villages for a similar plan of concentrated work.

Gentlemen, I have now great pleasure in declaring this eighth session of the Crops and Soils Wing open, and in doing so I wish you all success in your deliberations.

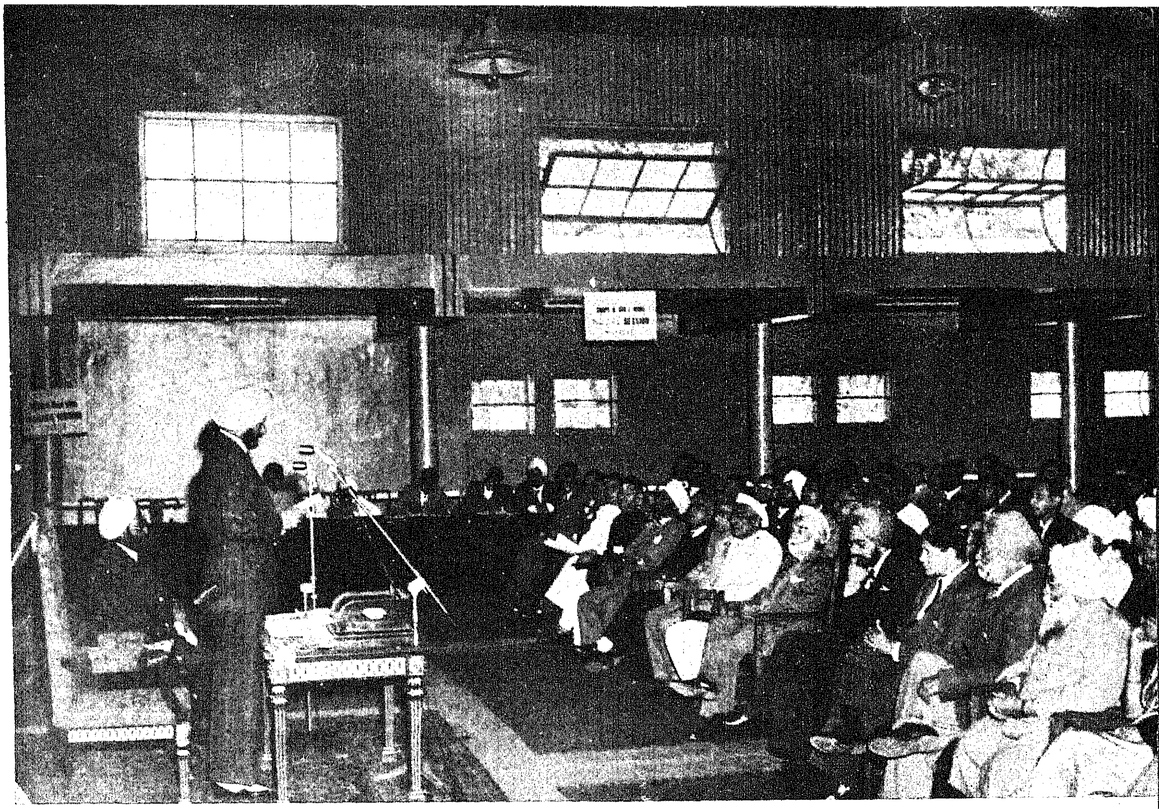

FIG. 1. Eighth meeting of the Crops and Soils Wing at Patiala. His Highness the Rajpramukh of PEPSU reading the inaugural address.

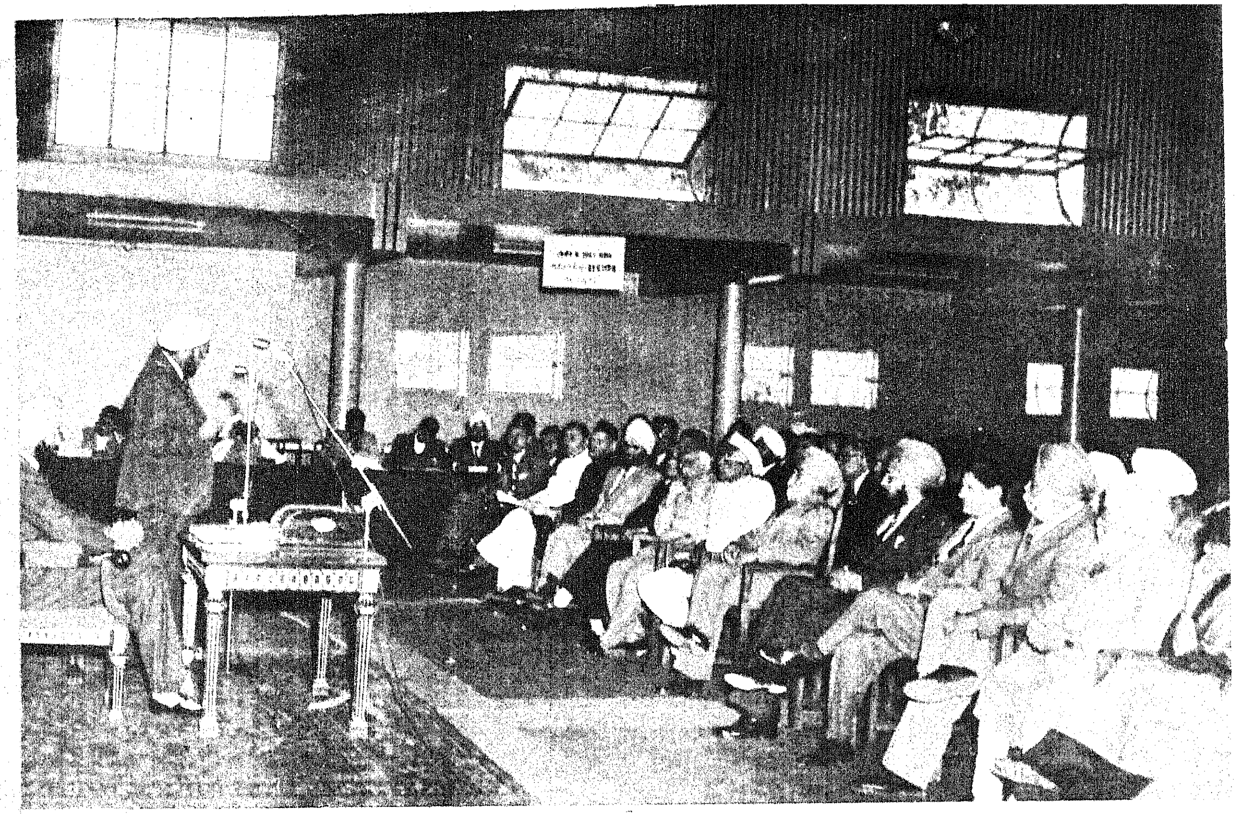

FIG. 2. Eighth meeting of the Crops and Soils Wing at Patiala. Opening speech by Sardar Datar Singh, Vice-Chairman, Indian Council of Agricultural Research.

Original Articles

REGIONALIZATION OF ANIMAL HUSBANDRY RESEARCH IN INDIA

By P. N. NANDA

ON the recommendation of the Royal Commission on Agriculture in India, the Indian Council of Agricultural Research was established in 1929 and was provided with an initial lump sum grant, annual recurring grants and special grants from the Government of India to undertake, aid, promote and coordinate agriculture and animal husbandry education, research, and its application in practice, development and marketing in India by all means calculated to increase scientific knowledge of the subjects and to secure its adoption in every day practice; and to act as a clearing house of information not only in regard to research but also in regard to agricultural and veterinary matters generally. The work of the Council is transacted by means of scientific and commodity committees, an Advisory Board and a Governing Body. The first three bodies consist of scientists, administrators and representatives of trade, while the fourth consists of Ministers in charge of Agriculture from the States and representatives of the Parliament and commerce interests.

Early years

During the early years of the Council, attention was directed so far as the animal husbandry side was concerned to the survey and control of diseases of animals and poultry, improvement of cattle, sheep, goats and poultry by selective breeding and cross-breeding with recognized indigenous and foreign breeds, nutritional research and investigations into the processing of milk and manufacture of dairy products. The procedure adopted was to consider schemes of research submitted by States and Central Research Institutes, or other Government or aided institutions, and also schemes sponsored by experts at the headquarters of the Council. The schemes were considered by the Advisory Board with the help of specially constituted Scientific and Commodity Committees. The recommendations of the Advisory Board were placed before the Governing Body for allotment of funds after fixing due priority of the schemes submitted.

The recurring grants received by the Council in its early years were not fixed and were subject to the vicissitudes of the revenues and financial position of the Government of India. In order to assure the Council of a steady income, the Government of India passed an Act in 1939 by which an *ad valorem* duty of ½ per cent was imposed on exports of certain agricultural and animal husbandry products which were not already taxed. This ensured a steady income to the Council since then unaffected by considerations of War or peace. A Standing Finance Committee was constituted to make recommendations regarding priority and allotment of funds.

Regionalization of research

It was felt in 1945 that the coordination hitherto attempted by the Council was lop-sided, and schemes emanated only from those provinces and States which were advanced in animal husbandry matters, while others continued to remain dormant for want of a suitable organization. This resulted in the development of certain portions of the sub-continent and concentration of the Council's

P. N. NANDA is Animal Husbandry Commissioner with the Government of India.

activities in particular areas. It was also felt that there was a certain amount of duplication of work which was not desirable. With a view to laying down a policy for the future, the Council appointed a Research Regionalization Committee to consider the question whether agricultural and animal husbandry research in India should be conducted on a provincial or regional basis. The Committee recommended that instead of sanctioning research schemes on a provincial basis as was being done, the Council should approve schemes in future to be conducted on a regional basis, so as to avoid wastage and overlapping of effort. This recommendation was accepted by the Council on an experimental basis and the country has for this purpose been divided broadly into the following regions :

(i) *Dry Northern (Wheat) Region*—comprising of the Punjab, Western Uttar Pradesh, Western Madhya Pradesh, Madhya Bharat, Rajasthan, and Patiala and East Punjab States Union.

(ii) A. *Wet Eastern (Rice) Region*—comprising of Assam, West Bengal, Bihar, Orissa, Eastern Madhya Pradesh, Eastern Uttar Pradesh and North East Madras.

(ii) B. *Coastal Region*—comprising of the two coastal strips in South India bordering on the Eastern and Western Ghats, parts of Mysore, Coorg, and Travancore-Cochin.

(iii) *Southern (Millet) Region*—comprising of Jhansi Division of Uttar Pradesh, Madhya Pradesh, Madyha Bharat, Eastern Hyderabad (Deccan), West Madras, Bombay and part of Mysore.

(iv) *Temperate Himalayan Region*—consisting of two sub-regions, viz. the Eastern Himalayan Region including Assam (hilly parts), Sikkim, Bhutan, Nepal and the Western Region including Kumaun, Garhwal, Simla, Kulu, Chamba and Kashmir.

Four Regional Committees were appointed to consider the schemes of research, both current and proposed, with a view to fit them in, into the regional plan. The Committee have since made their recommendations and these would now be placed before the Scientific Committees.

Some of the new schemes recommended for consideration on a regional basis are :

(i) Setting up Regional Nutrition Centres—one in each region.

(ii) Study of sterility in cattle on a regional basis and in various areas.

(iii) Study of trace elements and deficiency diseases.

(iv) Improvement of wool.

(v) Utilization of industrial by-products and unusual feeds for livestock.

'SUPERPHOSED' DRINKING WATER FOR STOCK

WESTERN Australian farmers have found the addition of superphosphate to drinking water to be a simple and efficient means of supplying phosphate to stock during the summer months.

It is important that correct amounts of superphosphate should be added. With training, cows will drink water containing 5 lb. of superphosphate to 100 gallons. This is the maximum amount that should be used and would be necessary only under emergency conditions.

In general practice, 2 lb. of superhposphate to 100 gallons gives excellent results. It does not affect the palatability of the drinking water and will each day supply a dairy cow with as much phosphorus as is present in two or three ounces of bonemeal.—*Australian Agricultural Newsletter*, No. AGN/291.

WOODY LEGUMES FOR THE POOR SOILS OF HUMID EQUATORIAL LOWLANDS

By ARTHUR T. SEMPLE and ROBERT L. PENDLETON

A LARGE proportion of the pasture lands in humid equatorial regions are on old terrains, undulating to slightly rolling or nearly flat. The soils of such terrain have been in place a very long time ; where the temperature is high and rainfall heavy, the plant nutrients have long since been almost completely leached out of the surface soils. This means that the soils are tather too extremely acid and there is almost no plant nutrient material available within the root zone of the usual grasses. For these reasons it seems reasonable to explore the possibilities of shrubby plants, particularly legumes which might have capabilities for pasture purposes which the grasses do not have.

Leucaena glauca

Henke and co-workers[1] in Hawaii made an extended study of the nutritive value and browse possibilities of *Leucaena glauca* known there as *koa haole*. *L. glauca* is a native of Middle America. In the regions where pastures were needed, they found that it was practically impossible to raise alfalfa or other herbaceous leguminous pasture plants but *koa haole* grew very well. It occurs in volunteer stands throughout the moderately dry to moderately moist parts of all of the islands. Naturally the yields are reduced by long periods without rain, but when the rains do come the plants are able to survive and make a quick recovery. Under Hawaiian conditions a minimum of about 20 in. of rainfall and maximum of about 65 in. per annum are generally its rainfall limits. *Koa haole* is a relatively temperature-sensitive crop. Normally it does not occur even in wild stands above 1,500 ft. at that latitude ; their experiments indicate that the rate of growth decreases rapidly with increase in elevation, and for soilage purposes, about 800 ft. is probably the maximum elevation. It is found in the lowlands with a higher rainfall than that indicated above, but only where the drainage is exceptionally good as on the gully slopes. According to Takahashi and Ripperton[2] a number of fertilizer trials have been made on established stands of *Koa haole* but with relatively little response to lime, phosphates, potash and even nitrogen. This was true even in soils having a *p*H of about 5·5, only a trace of available phosphates and only about 100 lb. of available potash per acre. Accordingly, it appears that *koa haole* is adapted to a relatively low soil fertility level and that good drainage is essential. However, in Thailand, this shrub grows well on heavy clay with the water table at less than one meter.

The Hawaiian beef ranchers have planted the seed rather extensively in their pastures and relatively large areas comprise a mixed stand of *koa haole* and various grasses, the most common mixture being Guinea grass and *koa haole*. This mixture represents some of the finest fattening paddocks in the Territory. It is recognized that *koa haole* cannot be grazed hard and continuously without being exterminated. In many pastures, however, moderate grazing is continued for as much as six months without

[1] Henke, L. A., Takahashi, M., Maruyama, C., Willett, E. L., Takazawa, F., Sherman, G. D., Quisenberry, J. H. and Draper, C. I. (1946). *Report of the University of Hawaii Agricultural Experiment Station* for the biennium ending June 30, 1946.

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[2] Takahashi, M. and Ripperton, J. C. (1949). Kao Haole, *Leucaena glauca*. Its establishment, culture and utilization as a forage crop with notes on other legumes. *Hawaii Agricultural Experiment Station Bulletin*, 100.

resting. One dairyman is grazing a planted stand which is adequately irrigated. He reports a carrying capacity of as much as three animals per acre per year, grazing the pastures four to five months throughout the year. He keeps his plants topped at about 3 to 4 ft. above ground level. This keeps the young shoots within reach of the browsing cattle and prevents the cows from snagging their udders on the stumps. It is obvious that this method of growing fodder requires a certain amount of handwork. Also probably a certain amount of fencing is necessary. Too often, however, in the tropics it is not considered economical to fence pasture. Nevertheless a pasture of nutritious browse plants of this type should certainly be worth fencing.

Nutritive value

In a carefully controlled and replicated experiment[3] an average ration of about 60 lb. of *koa haole* and 14 lb. of concentrates containing about 6 per cent of protein was superior to a practically equal ration of Napier grass and concentrates containing about 12 per cent of protein. For a 305-day lactation period, the production of cows fed *koa haole* was 8,804 lb. of milk while the equivalent production of the Napier grass fed cows was 7,651 lb. of milk.

Quisenberry and Draper[1] found that when *koa haole* leaf meal is fed at high concentrations it affects the health and production of chickens, but when fed at the lower levels necessary to replace alfalfa in the ration it is tolerated with no deleterious effects. The growth rates of chicks getting 7·5 per cent of *koa haole* leaf meal in their rations were definitely depressed, but at the 5 per cent level the chicks grew as well as alfalfa-fed birds, getting either 5 or 7·5 per cent of alfalfa meal. No difference in feathering was found between lots of chicks fed *koa haole* and alfalfa. Mortality was considerably lower among the chicks in the *koa haole* lots.

Pullets getting the *koa haole* were as heavy as those receiving alfalfa when they were placed in the laying pens. The birds fed *koa haole* came into sexual maturity at the same age as those fed alfalfa. However, birds in the *koa haole* lots showed a much deeper pigmentation, and yolks of the eggs laid were darker than those from the alfalfa lots. The carotene and vitamin A were higher in the eggs from the birds fed *koa haole*, also the hatchability of the eggs from the *koa haole* lots was considerably higher than that from the corresponding alfalfa lots.

For other non-ruminant animals, the use of *koa haole* is not recommended on account of the toxicity of the mimosine contained in the leaves. Willett, Henke and Maruyama[1] found that sows fed all of the fresh green *koa haole* they would consume for one month failed to conceive in spite of repeated services. It also lowered the reproductive efficiency of rabbits. Horses lose the hair in their manes and tails when they eat considerable quantities of *koa haole*.

For reforestation purposes

Pendleton[4] reports that in the Philippine Islands *L. glauca* (known there as *ipilipil*) is an important means of controlling cogon grass (*Imperata cylindrica*). If fire can be kept out of the cogon grass for about two years after broadcasting the *L. glauca* seed, the young plants will grow rapidly up through the grass and choke it out, so that in about three years one has a complete stand of leguminous shrubs. For reforestation purposes in the Philippine Islands, lines are cut through the dense stand of *ipilipil* which has choked out the cogon grass. Along these lines are planted seedlings of mahogany (*Swietenia macrophylla*) or other desired first class timbers. With occasional brushing out of the lines, the young trees thrive in the *ipilipil* nurse crop, whereas in those humid low latitudes it is prohibitively

[3] Hoekstra, P. (1949). Special communication Institute for Animal Husbandry, University of Indonesia, Buitenzorg, Java, Indonesia.

[1] Loc. cit.

[4] Pendleton, R. L. (1933). Cogonals and Reforestation with *Leucaena glauca*. *Lingnan Science Journal*, Canton, China, **12**, 555-568.

[4] Pendleton, R. L. (1934). Philippine Experience in Reforestation with Ipilipil (*Leucaena glauca*), and its Application to Conditions in Kwangtung Province, China. *Lingnan Science Journal* **13**, 211-224.

[4] Pendleton, R. L. (1935). Ipilipil—A Profitable Crop for Some of Those now Idle Sugarcane lands. *Sugar News* (Manila), **16**, 133-142.

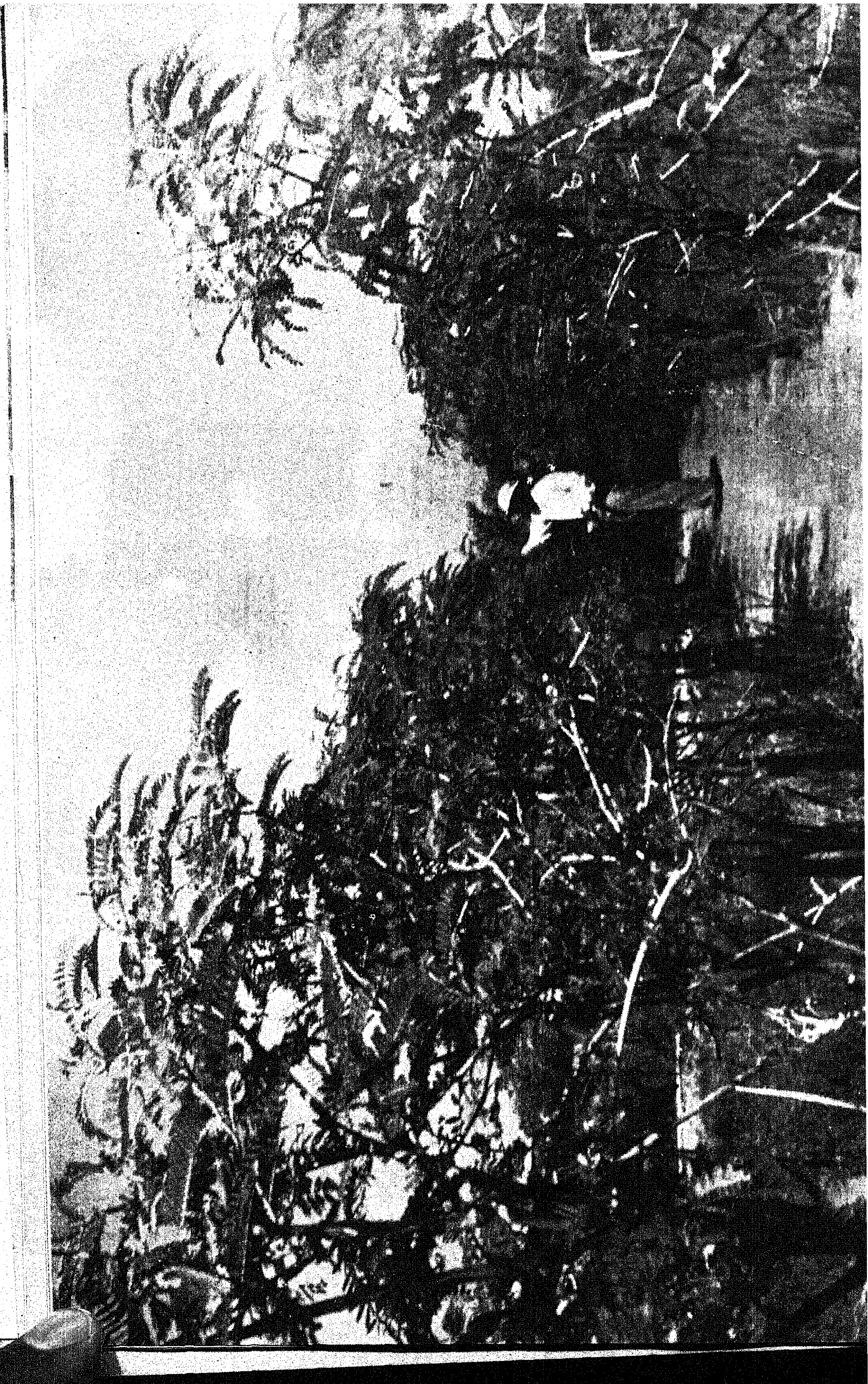
[4] Pendleton, R. L. (1948). Importance of Shrubs for Livestock Feeding in Humid Tropcial Regions. African Conference on Soils, Goma, Kivu, Belgian Congo. *Bulletin Agricole du Congo Belge* (in press).

PLATE 50

Ipilipil (*Leucaena glauca*) commonly dominates cogon and associated grasses within two to three years after the seed is planted, provided the area is protected from fire. Professor H. M. Curran, more than six feet tall, is first visible over the grass. Paliparan Reforestation Project, Los Banos, Laguna, Philippines. Photo by Robert L. Pendleton.

PLATE 51

Ton kae (*Sesbania grandiflora*) along path at the Agricultural College, Bangkhen, Bangkok plain, Thailand. The lower parts of the trees have been browsed by goats. The uppermost shoots have been repeatedly plucked for human food; the shoots are scalded, and then eaten as salad with a fish and pepper sauce. Photo by Robert L. Pendleton.



expensive as well as almost impossible biologically to establish and maintain healthy stands of forest trees by clean culture methods.

By sowing *L. glauca* seed in small blocks, a few meters square, scattered over areas of cogon grass it gradually develops and seeds the surrounding spaces until the brushy vegetation closes in, and kills the cogon grass. After this legume has been growing for six to eight years, the soil is greatly improved. Analyses at the College of Agriculture at Los Banos in the Philippines indicated that the amount of nitrogen in the soil under *L. glauca* had increased from less than 0·1 per cent to nearly 0·3 per cent.

On reasonably good, well-drained soils *L. glauca* grows so well that it can be cut back about every three years. Hence, in the Philippines it is grown for fuel wood in the Los Banos region in preference to raising bananas and ginger even though it is a 40-mile haul to take the wood from the plantation into Manila for sale.

Shrub in dooryards

In Thailand, *L. glauca* is naturalized in many places. It is often grown as a shrub in dooryards for the purpose of plucking from it the young shoots and young pods. These are eaten raw as a vegetable with vinegar and red pepper. They are indeed quite a palatable green for table use. It is noteworthy that this shrub or small tree grows well in dooryards and other places where pigs, chickens and cattle are about and it grows green throughout the long dry season even in very poor soils. Is it not logical that people should get their vegetables from shrubs that withstand adverse conditions rather than try to grow their greens as shallow-rooted annuals low down on the ground needing frequent watering and abundant fertilizing? According to Ochse[5] more than half of the foods which serve as vegetables in the East Indies are the young shoots, leaves or flowers of shrubs or trees. The Thai eat mango and other flower greens as salads. At the experiment station at Bangkok *L. glauca* is being grown on several acres of land to supply fodder for cattle and goats. It grows well on the low wet rice field soils where other types of leguminous fodders would not grow.

Sesbania grandiflora

However, the most important single leguminous shrub or tree used in Thailand for salad and fodder purposes is *Sesbania grandiflora*, known in Thailand as *ton kae*. This small leguminous tree grows very rapidly even on the heavy wet clay soil of the Bangkok plain. It is being planted more and more on the low dikes between rice fields and for light shade around farm buildings. By the Thai the large white flowers are used raw as a salad. The leaves and young shoots are relished by poultry, cattle and goats, and if the trees are managed by cutting back at a suitable height, a large supply of fresh fodder can be obtained through most of the dry season when very little else except rice straw and dry grass are available for the cattle. The people also eat the young shoots in a kind of curry.

Sesbania grandiflora is also much used as a browse plant for cattle in India. Ramiah[6] states that the tender shoots, leaves, flowers and tender pods are cooked and eaten by men and also are fed to cattle in India. According to Burkill[7] cattle eat the leaves of *S. grandiflora* in the Malay Peninsula with favourable effects upon the milk yield. This plant is also used extensively as a cattle food in Java, where it is topped to keep it low for convenience in reaching the tender shoots. Work[8] states that the pigeon-pea (*Cajanus cajan*) and *Desmanthus virgatus*, both shrublike legumes with woody stems, are extremely valuable in the rations of livestock in Hawaii.

Thus there is need to emphasize the importance of using tree crops wherever possible in humid tropical regions. Their roots go deep and so can reach moisture and plant nutrients which are far below the zone where they can be reached by grasses or herbaceous legumes. Tree crops need to be used much more extensively and used where possible in a forest-type of planting.

5 Ochse, J. J. (1931). *Vegetables of the Dutch East Indies.* Archipel Drukkerij, Buitenzorg, Java.

6 Ramiah, K. (1949). Special communication. Central Rice Research Institute, Nayabazar Post, Cuttack, Orissa, India.

7 Burkill, I. H. (1935). *A Dictionary of the Economic Produc's of the Malay Peninsula,* 2. Crown Agents for the Colonies, 4, Millbank, London, S.W.1.

8 Work, S. H. (1946). Digestible Nutrient content of some Hawaiian Feeds and Forages. *Tech. Bul. Univ. of Hawaii Agric. Exp. Sta.,* 4.

CORN COCKLE--A POISONOUS SEED IN IMPORTED WHEAT

By R. N. CHATTERJEE and M. B. RAIZADA

IN a consignment of imported wheat a certain weed seed was noticed, which was sent to us for identification.

According to the forwarding letter the seeds were previously analysed by the Chemical Examiner, Government of Bombay, and daturine was detected in them. But their Botanist was of opinion that the seed belonged to *Hibiscus* species, which, it was advised, to be non-toxic.

Plants were raised from the seeds and these were subsequently identified as *Lychnis githago* (Linn.) Scop., popularly known as corn cockle, or *Agrostemma.*

The presence of daturine, however, has not, so far, been reported in *Agrostemma* seeds. Further investigation is therefore necessary to establish the findings of the Chemical Examiner, Bombay, referred to above.

A notorious weed

Lychnis githago is a notorious weed of the wheat fields. It has attracted attention due, particularly, to the poisonous nature of its seed, which is toxic to stock and man[1], producing in each case poisoning as a result of its inclusion in foodstuffs. Though the poisonous principle is found in nearly all parts of the plant, the plant in the green state appears to be harmless, and is in any case rarely likely to be eaten fresh by stock, which probably refuse it on account of its hairy character. The poisonous principle is a glucoside variously known as githagin saponin, agrostemmin, sapotoxin, Agrostemma-sapotoxin or smilacin[2]. It is very easily soluble in water, in which it froths like soap when shaken up and it has a sharp taste and no odour. The principle appears to occur chiefly in the seeds, which contain from 4·9 to 7·7 per cent of the toxic saponins[1], but it has also been found in small quantities in other parts of the plant. Korsakoff[3] did not find saponin in very young seeds, but it appears in the seed as it reaches maturity. The amount of poisonous substance in the seed is variable, depending probably on the season and the soil. Experiments on the effects of poisoning on different kinds of livestock are rather variable. Feeding experiments on various domestic animals such as calves, pigs, fowls, dogs, etc. led to fatal results. It has also been determined that amounts varying from 0·1 to 0·9 lb. of seeds to 100 lb. of live weight are enough to cause death in such animals[2]. Pigs died in Germany with symptoms of acute poisoning when fed on trailings containing six per cent of corn cockle (*Agrostemma* seed). According to certain worker, 6 gm. of corn cockle seed consumed in 1,200 gm. of bread are beyond doubt poisonous in effect[2]. Though animals are reported to become tolerant of the poison, if the cockle is taken only in small regular doses, yet there appears to be a chronic form of poisoning due, termed githagism, to this cause, while acute poisoning results from the ingestion of large quantities of the seed, which may cause death in 24 hours or less. Young animals are more readily affected than the old ones and it is believed that rodents and sheep are not susceptible.

Symptoms of poisoning

A sufficient quantity of the toxic substance may cause nervous debility and dysentery. According to Chesnut[4], the main symptoms of poisoning are intense irritation of the

[1] Watt, J.M. and Breyer-Brandwijk, M.G. (1932). *Medicinal and Poisonous Plants of South Africa*, 50.
[2] Long, H. C. (1924). *Plants Poisonous to Livestock*, 20-22.

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[1] Loc. cit.
[2] Loc. cit.
[3] *Rev. Gen. Bot.* 1914 ; abstr. in *Exp. Sta. Record*, 1915, 524.
[4] Chesnut, V. K. (1898). *Thirty Poisonous Plants of the United States*, 11.

Lychnis githago Scop. (Corn cockle)
A. leafy twig with flower and capsule. B. seeds.

PLATE 52.

whole digestive tract, vomiting, headache, nausea, vertigo, diarrhoea, hot skin, sharp pains in the spine, difficult locomotion, and depressed breathing. Coma is sometimes present and may be followed by death. The chronic form of poisoning, which occurs when small doses are repeated over a long period (practically the only form observed in the case of human beings, but never in other animals, except perhaps in pigs) is characterized by gradual wasting away, loss of breath, loss of strength, chronic diarrhoea and nerve troubles, death taking place in marasmus and decline[2]. The toxic principle acts as an irritant of the digestive tract, causing colic and diarrhoea. There is thus ample evidence to warrant the statement that the ingestion of more than a very small quantity of corn cockle seed is dangerous and the consumption of even small quantities should be avoided[2].

Dangerous as food

Wheat mixed with *githago* seed is usually priced low in the market, so much so that the loss to wheat growers amounts to several million dollars annually in some of the wheat-growing centres in America. Seeds, if ground with wheat, render the flour unwholesome and even dangerous as food[5]. When ground up with wheat they both discolour the flour and impart a grey tint and disagreeable odour to breads made from such flour. Flour containing a considerable quantity of the cockle must, owing to the poisonous character of the latter, be held to be unfit for consumption. Fatal results have followed the use of breads containing corn cockle. Flour containing a smaller amount has often been made into bread and eaten, sometimes with fatal results, baking not always being sufficient to decompose the poison[4]. Corn cockle meal is easily detected in second and third class flour by the presence of black, roughened scales of the seed coat. These are sure to occur if the flour has not been well bolted. Its presence is otherwise detected by the peculiar odour produced when the meal is moistened and by chemical tests with iodine[4]. It is somewhat dificult to separate the seeds from cereal grains. Machinery is used to remove these seeds from wheat in the Western countries, but the difficulty of separating them is so great that the result is not entirely satisfactory. Accordingly sale of grain or flour containing corn cockle seed should be forbidden. It has also been held, in countries in which it grows, that the sale of feeding stuffs containing the cockle should be prohibited by law. Wheat containing corn cockle seeds should be rejected for planting.

[2] Loc. cit.

[4] Loc. cit.

[5] Walter Conard Muenscher (1945). *Poisonous Plants of the United States*, 74.

Descriptive details

Lychnis githago is a native of Europe and is reported to have been introduced into several other countries, viz. the United States, Canada, South Africa and there is some evidence of its entry in Turkey as well. As the seeds have already been imported mixed with wheat, it is not unlikely that it would gain a foothold, sooner or later, also in our country.

This plant, commonly known as corn cockle in the Western countries, belongs to the family Caryophyllaceae. Other names for corn cockle are rose campion, bastard nigella, old maids' pink, mullein pink, licheta and crown of the field. It is a very common winter annual weed of the wheat fields. There is no Indian name as the plant has not yet established itself in this country.

It is a herbaceous plant, about 2 to 3 ft. in height, with a slender, branched stem ; all the parts are covered with long, whitish silky hairs. Leaves opposite, simple, entire, lanceolate to linear. Flowers solitary on long slender peduncles ; calyx lobes 5, woolly, longer than corolla, calyx-tube 10-ribbed ; petals 5, purple to red-purple, showy, stamens 10 ; styles 5 ; ovary developing into a capsule with numerous seeds. Seeds are brownish-black to black in colour, about the size of wheat grains. They are prominently marked on the surface with rows of small warts (as shown in Plate 52).

In view of the frequent adulteration of foodstuffs at present and the harm resulting therefrom, it has been thought advisable to publish this short account of the plant in order to warn the wheat growers, consumers

[4] Loc. cit.

and the Government. Once it has established itself, the weed is difficult to eradicate, because the seeds are not readily screened from the wheat in the thresher or fanning mill.

Acknowledgment

Our thanks are due to Dr S. V. Puntambekar, Senior Research Officer, Chemistry and Minor Forest Products Branch of this Institute, for going through the manuscript*.

*The Director, Indian Agricultural Research Institute, New Delhi, was approached by the officers of the Ministry of Food for identification of some of the common weed seeds separated from imported wheat. Dr B. P. Pal, Head of the Division of Botany and his Assistant Botanist Mr. H. B. Singh identified a number of seeds among which *Lychnis githago* (Linn.) Scop., and *Lolium temulentum* Linn. (Darnel) were noticed on several occasions. Both these are poisonous to cattle and man. The poisonous nature of *Lolium temulentum* is due to an endophytic fungus related to Ustilagineae. An account of *Lolium* seeds separated from imported wheat has already been published by Greval and Bhaduri (*Ind. Med. Gazette* **81**, 294, August, 1946). Other weed seeds which were found in imported wheat were of *Saponaria vaccaria* Linn., *Polygonum* sp., *Vicia sativa* Linn., *Vicia hirsuta* Gray and inferior seeds of oats (*Avena* sp.).

As detailed information regarding the various weed seeds as also their poisonous properties, if any, is necessary so as to avoid risk of their spread in this country, it was suggested to the Government of India to arrange for obtaining information regarding the steps taken by the authorities in the exporting countries to clean bulk lots for their own consumption, and also to furnish the names of scientists in those countries who might let us know the weed seeds generally present in the exported foodgrains so that their help might be obtained in the matter.—*Ed.*

ARTIFICIAL INSEMINATION EXPERIMENTS WITH MERINOS

THE Australian Commonwealth Scientific and Industrial Research Organization's research farm at Trangie, New South Wales, reports 'fair success' in artificial insemination experiments conducted with merino sheep this seasons.

Trials covered two separate lots of ewes; the first aged Peppin-blood flock ewes and the second a mixed draft including many maidens. The two rams employed had registered average conceptions of 60 per cent with similar lots of ewes under natural service in similar seasonal conditions.

Of 414 inseminations from one ram 179 (43 per cent) resulted in conception while the second recorded 82 (63 per cent) conception from 129 inseminations.—*Australian Agricultural Newsletter*, No. AGN/291.

COMPOST DEVELOPMENT IN INDIA

By C. N. ACHARYA

THE process of compost-making is very old and was being followed, though in a crude and empirical manner, for thousands of years past in China, Japan and other countries. Even today, countries like China and Japan lead others in the quantity of compost manure prepared and applied to land ; this is shown in the case of Japan in Table I, the data presented in which relate to the year 1946.

TABLE I

Comparison of Japan and India in manure production

Particulars	Japan	India
Number of cattle and horses	4·5 millions	200 millions
Area under cultivation	14·44 million acres	200 million acres
Cattle (including horses) per acre of cultivated area	0·32	1·0
Total quantity of cattle-shed and rural compost prepared	62·8 million tons	220 million tons
Quantity of manure per acre of cultivated area	4·4 tons	1 ton
Quantity of plant nutrients added in the manure		
Nitrogen	52·3 lb. per acre	8 lb. per acre
P_2O_5	20·4 lb. per acre	3 lb. per acre
K_2O	44·8 lb. per acre	7 lb. per acre

Compost in Japan

A recent report prepared by Mr. B. R. Sen, who visited Japan on behalf of the FAO in 1948, states that 'among the various farm manures used by the Japanese farmers, compost is the most important source of plant food. In 1946, it supplied 47 per cent of the total nitrogen, 66 per cent of the total phosphoric acid and 64 per cent of the total potash applied to the soils of Japan. During the same year night-soil supplied 16 per cent, 8 per cent and 10 per cent.

It is well known that crop yields in China and Japan are much higher than those in India as shown in Table II.

The importance of compost manure in Japanese and Chinese agriculture was brought to the limelight as a result of the valuable book entitled *Farmers of Forty Centuries—Agriculture in China, Japan and Korea* which was published by F. H. King, of the U.S. Department of Agriculture in 1909, after a personal visit he paid to the above countries.

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TABLE II

Comparison of crop yields in different countries (from Statistical Year Book of the League of Nations 1933-34 Tables, 1947)

Country	Crop yields in lb. per acre			
	Wheat	Rice (Paddy)	Maize	Cotton
Egypt	1,918	2,998	1,891	535
Germany	2,017	..	2,228	..
Italy	1,383	4,568	2,079	170
Japan	1,713	3,444	1,392	196
U.S.A.	812	2,185	1,579	268
China	989	2,433	1,284	204
India	660	1,240	803	89

During the first world war of 1914-1918, England was faced with acute food shortage and her scientists at Rothamsted principally Russell and Richards developed the Adeo Process for converting straw and other farm wastes into manure by the addition of suitable chemicals. At about the same time, Waksman and his associates carried out considerable work on the subject in the United States. The work of Russell and Richards attracted considerable attention in India and investigations were started at Bangalore (by Dr G. J. Fowler), at Indore (by Sir Albert Howard) and at other centres like Coimbatore and Dacca, and processes were evolved for composting town and farm wastes into manure.

The processes indicated above were tried on a large scale during the period 1926-1930, when it became evident that agricultural conditions in India were quite different from those in England and America and more akin to those in China and Japan. As such our processes, if they were to be adopted on a large scale by farmers in India, should be simplified and made cheaper to suit Indian conditions.

Accordingly the Indian Council of Agricultural Research took up further investigations on the subject at the Indian Institute of Science, Bangalore, and entrusted the author, who had undergone training in compost research under Russell and Richards at Rothamsted, with the problem of working out processes that would be successful under Indian conditions.

The Bangalore Process of compost-making

During the period 1936-40, the Bangalore Process of compost-making was accordingly evolved and techniques were worked out for dealing with (a) urban refuse like town *katchra*, sewage, night-soil, etc., (b) village refuse like cattle-shed litter, dung, urine, house sweepings, leaves, etc., and (c) special types of waste material available in certain areas like sugarcane trash, forest leaves, water hyacinth, etc. The new processes consist briefly of packing trenches or pits with alternate layers of refuse and nitrogenous starter (sewage, night-soil, slaughter house waste, urine soaked refuse, dung, etc.) according to certain definite proportions and covering the trench with a layer of earth at the top. In the case of village refuse, an improved method of sectional filling of trenches and simple methods for conserving cattle urine have been worked out.

The processes mentioned above were given a good trial on a semi-large scale in Bombay State during 1941-42 and found to be quite suitable for Indian conditions.

Largescale development in India

Soon after the Bengal Famine of 1943, the Government of India decided that the Bangalore Process of compost-making should be tried out on the large scale and gave a special grant of Rs. 2¼ lakhs to the Indian Council of Agricultural Research for initiating work in all areas. The author, who was appointed Chief Biochemist in charge of the Scheme, conducted from August, 1943 to June, 1944 a special training course for a batch of Gazetted Officers (Biochemists and Compost Development Officers) from the then different provinces and States, in the theoretical, practical and organizational aspects of compost production. In August, 1945, the Ministry of Agriculture, Government of India, took over direct supervision of the Compost Schemes from the Council and invited all Provincial (now State) Governments to submit plans for largescale compost production from urban and rural waste material in their respective areas and offered to meet half the expenditure involved on such schemes.

Under the Town Refuse Composting Scheme, each State is given a staff consisting of one Biochemist or Compost Development Officer and a number of Assistants and Compost *Mistries* for the purpose of training the sanitary staff of municipalities in the Bangalore Process of composting urban refuse. In the case of municipalities with weak financial position, subsidies are offered for digging trenches and starting compost production. The manure is generally ready in four to six months' time after the trenches are filled up. The Agricultural Department gives necessary help to the municipalities by way of propaganda, transport facilities, etc. for distributing the manure produced to the surrounding villages.

The progress of work during the last five years under the Urban Compost Scheme is shown in Table III.

TABLE III

Development of Town Refuse Compost Schemes

Year	Number of urban centres preparing compost	Quantity produced during the year	Quantity sold
		Tons	Tons
1944-1945	260	182,610	51,290
1945-1946	411	282,670	179,910
1946-1947	578	409,860	289,170
*1947-1948	566	486,080	380,527
*1948-1949	686	708,094	502,913

*The data for 1947-1948 and 1948-1949 refer to the Indian Union area after partition.

The details of production and distribution in different areas of the country are shown in Table IV.

TABLE IV

Production and distribution of town compost in different areas

State	Number of centres in operation	Quantity of compost prepared during the year	Quantity of compost distributed during the year
		Tons	Tons
Ajmer-Merwara	4	3,976	2,289
Bihar	22	18,077	13,124
Bombay	88	127,926	52,460
Madhya Pradesh	94	61,864	42,626
Travancore-Cochin	20	9,882	10,260
Punjab	8	49,310	19,190
Delhi	4	14,797	14,797
Hyderabad	35	3,967	4,841
Madhya Bharat	26	13,998	9,299
Madras	93	112,980	104,168
Mysore	76	29,049	15,747
Orissa	8	4,670	1,418
Uttar Pradesh	183	244,678	205,667
West Bengal	25	12,920	7,027
Total	686	708,094	502,913

There are in all about 4,000 towns in India and by full utilization of the whole of the refuse material available in the area represented by these towns, it is estimated that nearly 100 lakh tons of compost manure could be prepared as against the present production of about 7 lakh tons. With a view to examining the reasons for the slow progress of the work, the Government of India appointed in March, 1948, a special committee, known as the Central Manure (Compost) Development Committee, which met at Nagpur in July, 1948, and at Jaipur in December, 1948, and made a number of recommendations for accelerating the pace of compost production, including one for amendment of the Municipal Act in all provinces and States as so to give power to the Government to compel municipalities to convert their refuse into manure for sale to agriculturists. The Committee at their Jaipur meeting (December, 1948) also fixed certain targets so as to double the existing level of manure production during 1949-1950 which have been modified in consultation with the provinces as indicated in Table V.

TABLE V

Targets for 1949-1950

State	Production target for 1949-1950
Ajmer-Merwara	9,000
Assam	1,000
Bihar	40,000
Bombay	150,000
Madhya Pradesh	90,000
Delhi	30,000
Punjab	50,000
Hyderabad	10,000
Madhya Bharat	30,000
Madras	150,000
Mysore	50,000
Orissa	10,000
Rajasthan Union	10,000
Travancore-Cochin	20,000
Uttar Pradesh	400,000
West Bengal	50,000
Total	1,100,000

The farmers in most areas have now become convinced of the value of urban compost and any prejudice they might have had in the past against manure prepared from town refuse and night-soil is rapidly disappearing when they find that the compost has no bad smell and resembles their cowdung manure in appearance and properties. Experimental trials carried out in different States and States Unions, both on Government Farms as well as on the cultivators' lands, have shown that in areas of assured water supply town compost has given even better results than cowdung manure on account of its richness in phosphoric acid. (Cowdung manure contains about 0·7 to 0·8 per cent nitrogen and 0·3 per cent phosphoric acid on the dry basis whereas town compost contains 1·0 to 1·2 per cent nitrogen and about 1 per cent phosphoric acid). An application of five cartloads ($2\frac{1}{2}$ tons) of town compost per acre has given increased yields averaging about two to three maunds of foodgrains and five to ten maunds of potatoes, vegetables, etc. Farmers are paying up to Rs. 7 to Rs. 8 per ton of town compost manure (including transport charges) indicating that the manure must be worth about Rs. 10 to 15 per ton in terms of extra crop production.

In view of the heavy demand for manure in all parts of the country, there is good scope for even exceeding the production targets fixed in Table IV for 1949-1950 if certain organizational difficulties are overcome. First, the lethargy and indifference shown by municipalities in converting their refuse into manure should be overcome by suitable amendment of the Municipal Act so as to give power to the Government concerned to compel municipalities to convert the whole of their refuse into manure. Secondly, the financial difficulties experienced by certain municipalities in acquiring lands for compost depots or purchasing carts or motor trucks for refuse collection or compost preparation should be overcome by the Government granting interest-free loan to be subsequently recovered from the sale of compost manure. Lastly, the absence of cheap distribution arrangements for manure should be overcome by the Government providing special motor trucks for manure distribution on a no-profit-no-loss basis; railway wagons should also be provided wherever necessary for long distance transport.

Utilization of sewage water and sludge

Much attention has not been devoted so far to the question of utilization of sewage and sludge, of which increasing quantities are produced from year to year, but which at present are mostly going to waste. It is estimated that in the 30 to 40 big cities, in which the sewerage system has been introduced even partially, there are produced daily about 500 million gallons of sewage, which contain about 100 tons of nitrogen per day, equivalent to about 182,500 tons of ammonium sulphate valued at over Rs. 5 crores per year. This 500 million gallons of effluent can irrigate about 100,000 acres and increase food production by about 100,000 tons. At present nearly 90 per cent of the sewage is allowed to run to waste into *nallas*, rivers or into sea. Sewage effluent contains both water and plant food and could be utilized for growing food crops, under suitable control of crop rotation and the dose of sewage applied. The experience of sewage farms, that have been in successful operation for several decades past at Poona, Ahmedabad, Madura, Hyderabad (Dn.), Delhi, etc. has shown that sewage effluent could be utilized for crop production on hygienic lines without causing nuisance or danger to health, if crop rotation and the dosage of sewage be properly controlled.

Quite recently an officer with considerable experience of sewage farming (Dr R. P. Talati) has been appointed as Assistant Compost Development Officer (Sewage Utilization); he has already visited a number of centres like Madras, Ahmedabad, Surat, Calcutta, etc. and prepared concrete schemes for utilizing the sewage available in these cities.

Rural compost schemes

Major attention and effort have so far been concentrated on urban compost schemes since the organizational part of this work is simpler and the results of extra manure production can be more easily verified. But the vast bulk of refuse is misused mostly in our villages and farms, where these are either not systematically collected or are used

for purposes other than manure preparation, e.g. burnt as fuel. The data given in Table VI will give an indication of the total quantity of refuse available in our villages and the amount at present converted into manure.

TABLE VI

Wastage of manure in our villages

	Dry matter	Nitrogen	Phosphoric acid	Potash
	(All figures are in millions of tons per year)			
Total quantity of waste matter produced by 150 million cattle as :				
Dung	133	1·659	0·664	0·995
Urine	26·5	3·319	0·020	4·979
Litter	34·8	0·187	0·056	0·286
Total	194·3	5·165	0·740	6·260
Recovered in 200 million tons of manure prepared at present	120·0	0·84	0·36	0·72

It would appear from the data given in Table VI that the wastage of plant food voided by the animals is greatest in the case of nitrogen and potash, and this is due to the defective methods of manure preparation adopted at present in the villages which do not utilize cattle urine as much as possible. As a result, the manure prepared at present in our villages contains only about 0·5 to 0·7 per cent nitrogen, about 0·3 per cent P_2O_5 and 0·6 to 0·7 per cent K_2O (on dry basis), whereas similar manure prepared in China, Japan, Europe and America contains from 2·0 to 2·5 per cent nitrogen, about 1·0 per cent P_2O_5 and 1·0 to 1·5 per cent K_2O (on dry basis). If the manure prepared in our villages could be raised to the above level, it would add an extra 1·5 million tons of nitrogen, 3 lakh tons of P_2O_5 and one million tons of K_2O to our soils, which could increase our food production by about 10 million tons per year.

On the initiative of the Government of India, almost all the States have started schemes for increasing manure production in villages and improving quality of the manure by adopting the compost system. The number of villages cooperating in the scheme and the quantity of manure produced during 1948-49 are shown in Table VII.

TABLE VII

Compost production under the Village Compost Schemes 1948-1949

State	Number of villages	Quantity of compost produced
Bombay	3,952	343,285 tons
Coorg	242	44,564 ,,
Punjab	314	45,050 ,,
Madras	5,838	43,544 ,,
Orissa	2,046	256,841 ,,
Uttar Pradesh	20,881	1,936,663 ,,
West Bengal	10,082	95,997 ,,
Total	43,355	2,765,944 tons

It would be seen from the data presented in Table VII that the extra manure produced under the Scheme amounts to about 60 tons per village, representing about 20 per cent increased production on the present level per village.

In order to check the accuracy of the data regarding increased production reported from the large number of villages operating the Compost Scheme, the Government of India have recommended to the States that random surveys should be carried out on a statistical basis.

A survey, as suggested, carried out in 75 villages selected at random in the centrally administered area of Ajmer-Merwara showed that the total average quantity of manure produced per village worked out at 963 cartloads (each cartload being equal to about 20 c. ft. or 10 maunds) equivalent to about 350 tons per village. There was a significant correlation between the number of cattle maintained and the quantity of manure produced, the average coming to about 45 c. ft. of manure per head of cattle.

When the reports from other States come in, it would be possible to work out estimates for (a) the average production of manure per village, (b) the average production of manure per head of cattle, and (c) the total quantity of manure produced in each area and in the Indian Union area as a whole.

The sample surveys are carried out by the existing District Staff of the State Agricultural Departments. The surveys are best carried out in the period April-June each year.

The data obtained from seven sample surveys would prove useful (a) to determine the extent to which cowdung and other refuse are used for purposes other than manure preparation, e.g. burnt for fuel or not collected at all, and (b) to ascertain the increase in manure production brought about in villages as a result of the compost drive. They would also provide a valuable yard-stick for fixing definite targets of increased manure production for each area.

Tree planting for fuel campaign

It is well known that a good proportion of cowdung, estimated at about 40 per cent to 60 per cent of the total quantity produced, which should properly go to the land as manure, is at present misused as fuel, due to acute fuel scarcity in several areas. On the occasion of the Independence Day celebrations on 15 August, 1948 the hon. Shri Jairamdas Daulatram, Minister for Food and Agriculture, Government of India, issued a special appeal to all the State Governments to organize tree planting campaigns for more fuel production in their respective areas. In pursuance of this appeal, which was widely broadcast, an intensive campaign for tree planting was carried on in all the States. The result of the campaign may be judged from the data given in Table VIII.

TABLE VIII

Tree planting campaign

State	Number planted
Madras	
Seedlings	11,34,611
Stumps or cuttings	93,222
Seeds	2,87,242 +
(Plus)	(7,960 1/2 lb.)
Bombay ..	7,60,000
Uttar Pradesh	7,50,000
Punjab ..	1,03,960
Madhya Pradesh	87,180
Delhi ..	50,000
Total	32,66,215

In addition to the tree planting work mentioned above in village surroundings, the State Forest Departments have started fuel plantations in selected areas for the purpose of supplying fuel to villagers at concession rates (Table IX).

TABLE IX

Fuel plantations by State Forest Departments

Bombay	Area
Surat District	342 acres
Sholapur District	668 ,,
Satara District	402 ,,
Belgaum District	1,247 ,,
Madras	20,261 ,,
Punjab	4,528 ,,
Bengal	700 ,,
Coorg	23 ,,
Total	28,171 acres

Programme for 1949-50

Recently the Government of India have decided that imports of food into India should be stopped by the end of 1951. A special merit of the compost programme is that it offers the means by which the country's food production could be increased by mobilizing the internal resources of the country, without having to depend on other countries for supply of machinery. In fact, every 100,000 tons of additional compost produced in the country would mean reduce food imports by about Rs. 10 lakhs. The money so far spent by the Government in organizing compost production has yielded fruitful results as shown in Table X.

The data given in Table X show that the expenditure on Compost Schemes is repaid 20 times by increased food production. If the total compost production is raised to a level of about 60 lakh tons per year, this would result in an increased food production worth about Rs. 6 crores.

TABLE X

Expenditure on compost schemes

Year	Grants made by Government of India for Compost Schemes	Quantity of compost produced in tons			Estimated value of extra food production
		From town refuse	From village refuse	Total	
1944–1945	Rs. 492,300	182,610	210,000	392,610	Rs. 39 lakhs
1945–1946	Rs. 488,532	282,670	520,000	802,670	Rs. 80 „
1946–1947	Rs. 926,697	409,360	829,000	1,238,360	Rs. 1·24 crores
1947–1948	Rs. 815,395	486,080	1,258,986	1,745,066	Rs. 1·75 „
1948–1949	Rs. 1,100,916	708,094	2,765,944	3,474,038	Rs. 3·74 „
Total	Rs. 3,823,840	2,068,814	5,583,930	7,652,744	Rs. 7·65 crores

HYBRID TOMATO PLANTS DEVELOPED IN UNITED STATES

HYBRID tomato plants that have a larger yield and a smoother fruit than common varieties have been developed in the United States. Horticulturists at Purdue University in the State of Indiana have been experimenting for the last three years with 33 varieties of tomatoes.

The Purdue scientists use the same principles in developing hybrid tomatoes that were used in developing hybrid corn. Just as hybrid corn greatly increased production in the United States, the scientists believe that tomato yields can be increased at least 15 to 20 per cent now and even higher in the future. For example, they crossed two tomato varieties—Pritchard and Rutgers. The resultant hybrid produced 17·8 tons an acre. The original varieties produced only 13 tons and 12·3 tons an acre, respectively.

The cross-breeding process also resulted in tomato plants having other favourable characteristics of the parent plants. One of the new varieties developed yields a good portion of its crop in the first third of the tomato season—an important factor in marketing.—*USIS.*

COOPERATIVE FARMING

By T. J. JOHN

INDIAN agriculture has in coming years a tremendous responsibility to discharge. The Indian agricultural economy is in a parlous condition, this fact has been brought out by India's inability to feed her population without taking recourse to imports though more than three-fourths of her population is devoted to agriculture. The United States, in which only 14 per cent of the workers are employed in farms feed not only the entire population of that country but also a substantial portion of the rest of the world. Great Britain, less than five per cent of whose working population is devoted to agriculture, raise one-third of the foodstuffs required by her. These figures reveal in a striking manner the very low efficiency of Indian agriculture.

Collective enterprise

There is no denying the fact that agricultural production is low in India partly due to the fact that agriculture is carried on in small units and by obsolete methods. In India the sense of private property is strong and social and economic conditions are not favourable to collective enterprise in the domain of agriculture. In this connection besides family farming three other types of farming may be considered, viz. cooperative, collective and State farming. Unless the present land system is materially altered, the deep attachment of the Indian peasant to his land would seriously stand in the way of creation of collective farms of the type seen today in Soviet Russia or Palestine. State farms are also not desirable except in cases in which the land is owned by the State. Hence, it is not surprising that thoughts and faiths are steadily veering in favour of cooperation in agriculture. The cooperative system, with a reorientation of its nature and aims, no doubt, offers the best avenue of progress in India.

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Cooperative farming holds out a great promise for our country as a means of mininizing farm costs and increasing agricultural production. Cooperative farms under the existing land system could be organized in our villages either by bringing together uneconomic contiguous holdings, or by taking on lease for long periods government lands or lands owned by landlords, which remain uncultivated or which are not properly cultivated, and subleasing them to poor agriculturists for long periods.

The members of a cooperative farm should be bona fide cultivators having previous experience of agriculture. For, the success of the enterprise depends largely on the selection of members, their ability to go through trying times during the formative stages of the society, their capacity to work for higher cooperative ideals and better living.

Before selecting a site for a cooperative farm in a village, a careful study of the local conditions should be made with special reference to agricultural conditions.

The two ways

In these cooperative farms agricultural operations could be done either separately or collectively without losing the individual rights of the members to their property. In the former case there may be a joint programme of cultivation, each member cultivating his own farm but according to a plan agreed upon by the members of the society. The members could cooperate for the purchase of farm requirements, the sale of farm produce and finance. They could as well provide for ownership of costly implements and other farm equipments, improvements in the technique of agriculture and some social services—all on a cooperative basis. In the latter case all agricultural operations could be done collectively. The capitalized value of the land held by each could be taken as shares contributed by each member and the produce from the farm as a whole could be divided, after

meeting the expenditure, and given to the members in proportion to the land owned by each. The shares belonging to each member, representing the capitalized value of land belonging to him, might be made transferable and negotiable, so that any number of subdivisions could be made in the shares without physically partitioning the land.

The management of the farm may either be by leaders elected by the members, or by a staff specially selected for management, keeping of accounts, allocation of tasks, marketing the produce, etc. The success of the enterprise will depend upon the ability of the leaders to bring about impartial and harmonious working as also upon tact and other qualifications of the supervising agent.

Help to members

The society should arrange to give to the members financial assistance when necessary for the purchase of cattle, manure, seeds and agricultural implements. It should extend tractor facilities, arrange for irrigation, decide what crops to be raised, distribute seeds and manures and look to the grading and sale of produce. In a similar way it should also organize supplementary occupations like rice-hulling, oil-crushing, bone-crushing, silage making and composting, sericulture, poultry rearing, manufacture of agricultural implements, etc.; these may provide work for ryots in off seasons.

The State should offer such assistance as free service from its technical departments, viz. Agricultural, Veterinary, Public Health, etc. in the planning and development of the farm. 'The role of the government in relation to cooperative societies should be one of active helpfulness, intended to stimulate cooperative enterprise, guide it, keep it on sound lines, without either attempting to compel or replace local initiative or self-help.'

Educative propaganda

The great need in our country is to make the common man realize the benefits of corporate life. It is essential to convert the agriculturists, conservative as they are, by demonstrating to them the benefits of cooperative farming, and how well such farms function, by organizing model co-operative units in different centres. Ryots must be taught to appreciate the significance and value of cooperative methods. For, normally, every individual farmer likes to work alone in his farm, and would not like to surrender even a part of his individualism or economic freedom to any association, unless he is assured of material gain. Hence the usefulness of the movement should be brought home to the farmers, and the spirit of cooperation spread through educative propaganda.

Agriculture is today India's largest industry; it will remain so for ages to come. It is tragic that an industry of such a great importance happens to be in such a backward state. The cause is to be formed in the social and economic conditions and the land system in the country. These have to be corrected or modified to improve the agricultural economy of the country. The time is not ripe for any measures that would totally upset the present agricultural set up. In the circumstances, cooperation is a potent instrument for effecting agricultural improvements and a panacea for some of the evils that hamper agricultural production in this country.

IMPROVEMENT OF PADDY IN TRAVANCORE*

A SCHEME for the improvement of rice in Travancore* was financed by the Indian Council of Agricultural Research from October, 1940 to end of March, 1949.

The work comprised of:

(a) Collection of paddy varieties from a wide range of places in India.

(b) Pure line selection for high yield, resistance to acidity and salinity from local types.

(c) Study of effect of drying sprouted seeds on their viability.

(d) Determination of the most economic seed rate for broadcasting.

Collection of paddy varieties

At the Paddy Breeding Station, Monkompu, over 100 type-collections were maintained, their morphological characters in the field studied and pure lines isolated.

Resistance to acidity and alkalinity

From 'Chetti Virippu' variety grown in saline coastal areas, possessing salt and acid resisting qualities, a pure line MO.1 was isolated. This strain yields on an average 1,800 lb. per acre which represents an increase of 20 per cent over the local.

Another strain MO.2 was evolved from the popular local rice 'Kallada Samba'. Its yield is on an average 2,000 lb. per acre which is 22 per cent more than the local variety. Of the varieties collected from outside the State and tested, Ptb. 10 proved the most promising during three seasons. Its yield was 20 per cent higher than the most popular variety of the same duration.

Seeds of the three improved strains mentioned above (MO.1, MO.2 and Ptb.10) were multiplied and distributed to the cultivators. A Seed Multiplication Scheme was put into operation in 1948. It has been reported that in June 1948 32,353 lb. of seeds of the three strains were supplied to the cultivators and that 1,59,840 lb. seeds were in stock for distribution during the next season.

At the Paddy Breeding Station, Adoor, a number of improved strains have been evolved from eight local varieties, giving higher yields over the local, ranging from 16 to 28 per cent. Special mention may be made of strains Adr. 74 and Adr. 77 which yield 3,196 and 2,641 lb. per acre respectively.

Sprouted seeds

According to the practice in vogue sprouted seeds of short duration varieties of paddy are broadcast when there is knee-deep water in the fields. But owing to certain factors beyond control, sowing has sometimes to be suddenly postponed and sprouted seeds preserved. An experiment was therefore undertaken with a view to find out the effect of varying durations of rest on the re-germinating capacity of sprouted seeds which were previously dried. The results obtained over three successive seasons led to the conclusion that the sprouted seeds could be kept for a period of 30 days after drying (in the sun or shade) without detriment to their re-germinating capacity.

Economic seed rate

The general practice adopted by all cultivators is to broadcast sprouted seeds at rates varying from 110 to 150 lb. per acre and transplanting is not resorted to at all. It was, therefore, necessary to determine the most economical seed rate. Two varieties MO.1 and MO.2 were sown at five seed rates (70, 90, 110, 130 and 150 lb. per acre respectively) over three seasons (1947, 1948 and 1949). The highest yields on an average of the three seasons were obtained with a seed rate of 90 lb. per acre; this seed rate is therefore most economical. (R.S.)

*Now Travancore-Cochin.

You ask We answer

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in States. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

HYBRID CORN

Q. What is hybrid corn, how does it increase the yield and what work is being done on it in India ?

A. Research in the United States on breeding of maize revealed that when plants of the same variety are crossed among themselves (inbreeding), it causes deterioration of the crop through reduction in vigour and yield. But when varieties of maize, purified by selection through five or six successive years (inbred lines) and possessing desirable characters, were mated with each other vigorous hybrids far excelling either parental variety could be produced. This discovery led to the production of hybrid corn on a commercial scale. The hybrid corn increased yields so much and thereby proved so remunerative to the grower that in 1947 it was estimated that 74 per cent of the entire corn-growing area in the United States was grown under it. In the principal corn-growing States the figures were as high as 99 to 100 per cent.

Taking advantage of this discovery experiments on production of hybrid maize were initiated under the auspices of the Indian Council of Agricultural Research. A maize breeding scheme came into operation in October, 1945 in the undivided Punjab. It is at present in progress in the Punjab at three centres, i.e. Jullundur, Kulu and Kangra.

As a result of the work done so far, promising inbred lines of maize possessing high potentialities for yield and other desirable agricultural characters have been produced and further work on the production of hybrid maize through crossing inbreds is in progress. Similar schemes have also been sanctioned in other important maize producing areas such as Uttar Pradesh, Bihar and Bengal. It will take some time to purify the existing varieties and to bring them to a stage at which they would be suitable for sowing with other similar varieties to produce hybrid corn.

As hybrid corn retains its superiority for only one generation, hybrid seed has to be produced every year afresh for sowing. It was, therefore, necessary to undertake research to cut short the period taken at present (five to six years) to produce inbred lines and to simplify the present-day technique of producing hybrid corns. A scheme with this object in view came into operation on 1 April, 1946 at the Indian Agricultural Research Institute, New Delhi, and results are awaited.

In addition to breeding hybrid corn in India, varieties are also being imported from the United States for small scale trials in the various maize-growing regions in the country with a view to discover whether any of the foreign types would be suitable for cultivation. (R.S.)

What's doing in All-India

RESEARCH AND FOOD PROBLEM*

AS Chairman of the Board of Agriculture and Animal Husbandry in India, it gives me great pleasure to welcome you all to this, the eighth meeting of the Crops and Soils Wing of the Board. According to our usual convention, meetings of the two Wings of the Board are held every year alternately in Delhi and in the capital of one of the States. The last meeting of this Wing was held in Madras in April, 1948 and, normally, this meeting should have been held in Delhi. Owing to difficult conditions now prevailing in Delhi, however, we have had to hold it outside this time also and it was kind of the Government of PEPSU to have invited us to this historic place, which is now the capital of one of the latest Unions affiliated to the Indian Council of Agricultural Research. This also gives us an opportunity of meeting His Highness the Rajpramukh who, besides his other qualities of head and heart, is well known for the great interest he takes in the development of agriculture. His Highness's farm, which is not very far from here, is one of the most up-to-date and well-equipped private farms in this part of the country, and I am sure you are all looking forward keenly to pay a visit to it. We are indebted to the Chief Minister of the State and to Sardar Kartar Singh, Director of Agriculture, and other officers of the PEPSU for the excellent arrangements they have made for us in every respect, although Patiala is not even on the main railway line and in spite of these days of general shortage and high prices.

Before I mention the agenda of the meeting, I must refer to the very sad and untimely demise early in December 1949 of Shri S. M. Srivastava. He was the Secretary of the Indian Council of Agricultural Research for a number of years and was its Joint Vice-Chairman for about eight months at the time of his death. In him the Council has lost a very able and reliable officer and I am sure you will like me to place on record our deep sense of sorrow on his death and convey our sympathy to his family.

As you all know, the Board of Agriculture and Animal Husbandry in India was established 45 years ago. In 1931, it was split up into two Wings, one for Crops and Soils, and the other for Animal Husbandry. Composed as they are, these two Wings have been aptly described as the Agricultural Parliament of India. Considerable weight is, therefore, attached to their recommendations. In the present context of shortage of essential foodstuffs, the country will be expecting from this body comprehensive and practical advice on the burning problems of the day. The agenda for this meeting is almost entirely devoted to the consideration of such questions and I am looking forward to very useful discussions at the meetings of the Committees and at the plenary session of this Board which are to take place during the next three days.

The agenda of the meeting will provide you with the fullest opportunity to make suggestions with regard to certain aspects of the food problem. One of the items relates to the importance of subsidiary foods and alternate food crops, particularly root crops like tapioca, sweet potatoes, yams, etc. for making up the deficit of foodgrains. We subsist mostly on wheat and rice at present and, naturally, emphasis is laid on the production of these two basic cereals. But, there are other articles of food which are very good from the point of view of a balanced diet and which can give far greater yield than the cereals. They are palatable and can, with advantage,

*Opening speech by Sardar Datar Singh, Vice-Chairman, Indian Council of Agricultural Research, at the inaugural session of the Crops and Soils Wing of the Board of Agriculture and Animal Husbandry in India, at Patiala on 28 March, 1950.

be substituted to a certain extent against cereals in our diet. We have a large wealth of indigenous root crops and it is only a question of collecting and introducing them wherever they can thrive well. The Indian Council of Agricultural Research has already taken up the question of improving the production of tuber crops and has sanctioned a few schemes for breeding high yielding varieties and their multiplication in areas where they can be successfully grown. Apart from their use as food, some root crops are also useful as a source of starch which is required in larger quantities in various industries.

Another subject which will need your careful consideration will be the consistently low yields of major food-crops in India as compared with other countries and the remedies to overcome this defect. It is very disturbing indeed that while other countries are going ahead in respect of yield, we in this country should be content with low yields, which have been consistently falling in almost all crops. If only these acre yields can be raised to reasonable levels, we shall be solving our food problem to a considerable extent. Several of the factors responsible for this fall are already known such as the need for consolidation of holdings, improved supply of water, manure and better seed, adoption of better methods of cultivation, etc. but there are other factors which have been investigated by scientists and the results of which have to be brought to the notice of the farmer. I expect that the discussions on the subject will throw further light on the practical measures which can be adopted for raising the level of production in the country.

The agenda also includes subjects referring to other measures for increasing the yield of crops. For instance, the eradication of weeds is a problem which requires quick and careful attention because weeds cause considerable loss in crop yields by taking away water, plant nutrients, etc. for their own growth. In West Bengal alone, it has been estimated that deep water paddy worth about 11 crores of rupees is destroyed annually due to depredation of water hyacinth. Not only foodgrains but also other important cash crops like cotton, tobacco, sugarcane, etc. are affected by weeds. It has been pointed out by some workers that the loss to crops on account of weeds may sometimes be as high as 30 per cent. The magnitude of the problem, therefore, is obvious. The Indian Council of Agricultural Research has initiated certain schemes on the use of chemicals for eradication of weeds but more extensive and vigorous measures are necessary to eliminate this huge waste.

The other important problem is that of ensuring the continued supply of standard seed material which is free from diseases. As you are aware, the use of improved seeds alone has been found to increase yields of crops by 10 to 15 per cent and much higher percentages in certain cases. The measures necessary for ensuring that pure seed is available for all the important crops in adequate quantities, and for the maintenance of the standards of purity are, therefore, important. In the case of potatoes, on the initiative of the Indian Council of Agricultural Research a seed certification scheme is already being worked by the Government of India under the Central Potato Research Institute. The seed testing stations have been established in other advanced countries to supply pure seed to the cultivators. On account of the importance of this subject the item has been included in the agenda for discussion by the Board, and I have no doubt that your deliberations will result in giving the necessary guidance to the country in this respect.

The last, though not the least important subject on the agenda relates to the organization of extension and developmental work in agriculture. All of you must be aware of the rapid progress which has been made by western countries, more especially America, in improving their agriculture by prompt and effective introduction of useful results of research in the cultivator's actual practice. The importance of an efficient extension service on a country-wide scale cannot be too strongly stressed in a country like India where very little in this direction has been done in a systematic manner so far. It has been complained in the press as well as in the Parliament that the results of research carried out in the country have not been made available yet to the practical farmer. The President of

the Republic has also drawn attention to this aspect of the problem in one of his recent speeches. The Indian Council of Agricultural Research is devoting particular attention to this question on a limited scale and has launched a model scheme for the development of a group of ten villages near Delhi where efforts are being made to improve the agricultural conditions with the cooperation of the villagers themselves. In this scheme, the Council is trying to introduce various improved methods of farming, such as use of improved seed, fruit plants, implements, improved breeds of livestock including cattle, pigs, fowl, etc. in a coordinated manner and it is proposed to assess the results of these activities on the income and general prosperity of the villagers from year to year. The Council has made available for this scheme the services of its Expert Advisers and has also placed a small supervisory staff in each of the villages with a central officer in charge of the scheme as a whole. The planning and execution of the details are being carefully scrutinized by the Council and the villagers are closely associated with the whole project by setting up one small committee for each village and one central committee for the 10 villages put together, the staff provided by the Council being made to work under these committees. This activity has been commented upon favourably by visitors, Indian as well as foreigners, and the experiment is being watched with great interest throughout the country. The results are, no doubt, encouraging at the moment but it is too early to draw definite conclusions yet. Apart from the organization of an efficient extension service on a country-wide scale, vigorous propaganda is also necessary for the purpose of bringing home the results of research to the notice of the farmer. I am glad to say that this matter is also receiving the careful attention of the Indian Council of Agricultural Research and I hope that before long we shall have a nucleus organization which will specialize in such publicity and propaganda. The actual field work, however, should be entirely the responsibility of the States and I hope that the representatives from the States who are here will benefit greatly from the discussions on this important subject.

It is an undisputed fact that the population of India is increasing. Heavy responsibility, therefore, rests on the shoulders of those who are concerned with research and development of agriculture in this country. It should be our endeavour to develop agriculture in the country to such an extent that we will not only be able to meet the needs of our growing population on a satisfactory scale but also leave some margin for export of our produce to outside countries. For solving this problem this Board can make useful suggestions.

Immediately preceding this meeting we have had two conferences, one of entomologists and the other of mycologists, and there is to be a combined conference of both today. As most of you are aware, it has been the practice of the Indian Council of Agricultural Research to hold such periodical conferences of specialists in order that the active scientific workers may have an opportunity to meet each other and exchange ideas. The two conferences on this occasion are of particular importance at this juncture because the food problem has its entomological and mycological aspects too. You are all aware of the very large losses caused to foodstuffs in the field and in storage due to attack by insects, pests and diseases. If as a result of their deliberations, our scientists can suggest any means by which these losses can be obviated they will be making one of the most valuable contributions towards the solution of the food problem of the country.

I do not wish to take any more of your time in enlarging on any other topic. We have yet to split up into committees and to discuss the various subjects. I will now request Your Highness to inaugurate the meeting. I cannot adequately say how deeply grateful we all are to you, Sir, for very kindly agreeing to be present here, this morning and to address us in spite of your various other preoccupations. I hope that after inaugurating the meeting, Your Highness, the hon. Ministers and the other distinguished officers of the Union who are present here will find it convenient to spare some time and take part in our deliberations.

PLANT PROTECTION WORK IN INDIA DURING 1949*

AFTER the end of locust cycle in 1946 India remained practically free from locusts up to the winter-spring of 1948-49. A sudden rise was, however, observed in the second fortnight of May due to the influx of exotic locusts from the west which continued during July and August swelling up population to 19,200 square miles on July 13 at Kakoo, in Bikaner. Favourable rainfall induced locust breeding during July and August in parts of Bikaner and Jodhpur. In Bikaner 150 square miles and in Jodhpur 25 square miles of area were affected. Some locusts escaped destruction. 'Second generation' breeding during October and November occurred in the western parts of Bikaner and Jaiselmer. At this time, the Indo-Pakistan border along Jaiselmer and Bikaner was the site of migration of large numbers of locust hoppers from the Khairpur Mirs State and the Bahawalpur area of Pakistan. Breeding on extensive scale was observed in west Jaiselmer from Kishengarh to Shahgarh over an area of 100 × 20 square miles on both sides of the border and hopper bands penetrated inland in large numbers from Pakistan side, one such band was observed over an area of 25 × 10 square miles north of Ramgarh in the middle of November. Since local labour was scarce, the military had to be requested to aid, and with their help this breeding, which would have otherwise resulted in escape of large number of swarms, was controlled effectively. The Government of India has already decided to strengthen the Locust Warning Organization and has asked the State Governments to revive their anti-locust organizations.

Wheat rust control

Supervision of the prohibition of summer wheat cultivation was continued in Peninsular India. Prohibition was complete in Madras State where no summer wheat or barley crop was grown and the farmers raised potatoes, gram and millets instead. In Mysore and Bombay, however, small scattered areas of summer wheat were grown. About 360 acres of summer wheat crop (unauthorized) in different localities of Mysore and about 10 acres of the crop in the three southern districts of Bombay State were got harrowed up. Summer wheat over a small area in Mysore escaped detection. As a result of the survey carried out in important wheat growing localities in Southern and Peninsular India, it is revealed that rust had not yet appeared or was very negligible, on the *rabi* crops in Madras, Hyderabad, Madhya Pradesh and Mysore but in some parts of Bombay there was appreciable incidence of the disease.

Fluted scale

Considerable reduction in the incidence of Fluted Scale (*Icerya purchasi*) was obtained by the release of 10,000 predators—Rodoliza beetles in Madras Presidency, Mysore State and Travancore-Cochin.

Plant protection work in States

Ajmer-Merwara : An attack of *Phadka*-grasshopper on maize, *jowar*, *bajra*, etc. occurred over a large area of which about 30,000 acres was treated resulting in an increase of 1,38,000 maunds in the yield. The expenditure amounted to about Rs. 1,85,000. A complete absence of smut was obtained by treatment of about 731 maunds of *jowar* seed used for sowing about 3,000 acres. About 8,000 maunds of barley and 3,000 maunds of wheat to cover an area of about 11,000 acres were treated against Foot-rot and Covered smut.

Delhi : Control operations were undertaken against *Singhara* beetle over a small area and a saving of crop worth more than Rs. 30,000 was effected. About 1,875 maunds of *jowar* for 7,500 acres and 1,665 maunds of wheat for 2,000 acres were treated against Smut and Foot-rot respectively. About 1,100 trees and 19,600 seedlings of citrus were sprayed in different villages against Canker, Die-back and Mottle leaf.

*By the Plant Protection Adviser to the Government of India.

Coorg : Nearly 33,800 maunds of paddy was saved over an area of 4,806 acres as a result of the treatment against Hispa and Caseworm pests. About 275 tons of paddy seed for 15,800 acres were treated against Seedling blight and Foot-rot. About 3,000 acres of oranges were treated against Leaf fall and Fruit rot and about 33 acres of orange seedlings against Powdery mildew. These measures gave about 20 per cent increase in fruit. About 806 acres of coffee were sprayed against Leaf-rot and other fungal diseases while 75 acres of arecanut were sprayed against Koleroga disease. About 15 acres of cardamom were sprayed against a Leaf spot disease.

Uttar Pradesh : Considerable damage from grasshoppers and other pests to sugarcane, maize, *jowar* and paddy and vegetable crops covering an area of about 900 acres was checked by dusting and spraying operations. Similarly, 1,867 fruit trees were sprayed against Fruit borer, Woolly aphis and Mango hoppers.

Wheat (4,558 maunds) and barley (36 maunds) seeds for 4,600 acres were treated against Foot-rot and 978 maunds of *jowar* to cover for 3,912 acres were treated against Foot-rot and Smuts. Apple trees (7,631) treated against Stem black, Stem brown, Pink disease and Collar rot in Almora and Nainital districts. About 4,000 nursery plants and 128 trees of apple in Garhwal district were dusted against Powdery mildew. In Meerut District 142 trees of mango were treated with Chaubattia paste against Die-back. The expected increased yield is about 10 per cent as a result of these measures. Further spread of Downy mildew over 11 acres of cucurbit crop was prevented by spraying.

Bombay : The Deccan wingless-grasshopper infesting paddy over 28,811 acres and Rice grasshopper over an area of 28,000 acres were controlled resulting in an increased yield of 11,20,000 maunds in the case of the latter. (The figures for the former are awaited).

Madras : Control of Rice grasshopper on paddy over an area of 8,000 acres and other pests over 10,000 acres resulted in increased yield of 56,000 maunds and 83,000 maunds of grain respectively. Destruction of field rats over an area of 6,27,200 acres saved 48 lakh maunds of paddy.

Foot-rot and Seedling blight of paddy were effectively controlled by treatment of paddy seed for 4,130 acres. Three hundred and fifty-six acres of paddy nurseries were sprayed against Blast disease. Also seed of Blast resistant varieties of paddy (Co. 25 and Co. 26) was distributed over an area of 40,000 acres. Treatment of sorghum seeds for the control of Smuts is a routine practice in all districts of Madras State. During the period under report about 1,26,183 acres were put under the treated seed. As the seed-borne diseases cause a loss every year of at least 15 per cent, this much saving has thus been made.

About 445 acres and 4,200 trees of citrus were sprayed against Mottle leaf, while about 25 acres and 1,324 trees of citrus were sprayed against Die-back and Canker. A new disease of citrus caused by *Septobasidium* sp. was effectively controlled by spraying over an area of 200 acres, with a resultant increase of about five per cent in yield. About 1,560 acres of areca palms were sprayed against 'Mahali' disease ; nearly 25 per cent more yield is expected. About 73 acres of grapevine and 12 acres of potatoes were sprayed against Mildew and Early blight respectively. Eleven acres of chillies and 140 acres of turmeric were sprayed against Fruit rot and Leaf spot diseases respectively. About 27 acres of tobacco were sprayed against Damping off.

West Bengal : Paddy over an area of 9,200 acres was treated against insect pests saving a crop worth about Rs. 44,000. Potato crop over an area of 1,000 acres was treated against Epilachna beetles with the resultant saving of about 5,000 maunds of potatoes. About 40,000 maunds of paddy seed to cover about 1,20,000 acres were treated against Seedling blight which gave much healthier stands as compared to the crop raised with untreated seed. Also 800 maunds wheat seed was treated against Foot-rot. About 1,300 acres of potato crop in Darjeeling district and surrounding areas were sprayed against Late blight. The work of spraying potato crop in the plains against Early blight was continued. The yield of potatoes which is only 70 maunds per acre in the plains went up to 100 maunds as a result.

Assam : The potato crop in the Khasi and

Jainti hills was sprayed against Blight, while 2,500 citrus trees against Canker and Scab.

Travancore-Cochin : Nearly 1,300 acres of paddy was dusted against *Leptispa* and other pests bringing down the intensity of the pest by about 80 per cent. Similar measures taken against paddy pests in Cochin gave a saving of nearly 1,12,500 maunds of paddy.

Food and seedgrain storage

Work on foodgrain storage was continued in Ajmer-Merwara and Delhi. The Court of Wards, Ajmer-Merwara, responsible for storing of over two lakh maunds of grain every year in that State, have adopted scientific methods for preserving grain against insects, rats and moulds. Villagers are being assisted in Ajmer-Merwara to build up small stores on scientific lines with the necessary help of the Government. Similar work is being organized in Delhi. A model *pucca* store with a capacity of 1,000 maunds of grain was recently constructed in Jethana village (Ajmer-Merwara) wherein grain, if infested, can be treated with modern insecticidal methods. More than 5,000 maunds of seed-grain was fumigated and about 2,000 maunds preserved with proper preservative (DDT) in Ajmer and Delhi. Several thousand burrows of field rats were destroyed in different villages in Delhi.

A brochure entitled *Protect food and seed-grain against insects, rats and moulds* has been published to serve as a practical guide to officers of Rural and Agricultural Departments. An advisory leaflet entitled *Methods of rat control in foodgrain godowns* was also published.

Quarantine work

An Inspection House for plants and plant products was established at Bombay and the work of erection of a modern fumigatorium was in progress. Advice on various points relating to quarantine work was given to numerous correspondents as well as to Government institutions in India. Method of using methyl bromide for fumigating imported cotton seed was explained to the Indian Central Cotton Committee.

PUNJAB

M. R. AHLAWAT

RAIN received towards the end of September, and beginning of October, 1949, proved very beneficial to such of the standing *kharif* crops as had been able to brave the rather long spell of drought. But more than that it enabled the farmers, especially in the arid south-eastern districts, to put under the *rabi* crops all the fallow land and most of the area vacated by *kharif* crops.

Land reclamation

It has been estimated, roughly though, that the State has some 25 lakh acres of land of the category 'culturable waste', about 25 per cent of which lies in Karnal District alone. The class of wasteland which can, after reclamation, be put under crops most quickly is the *bet* or riverain land, as crops on such lands can be grown quite successfully without artificial irrigation. A scheme for the reclamation of 10,000 acres of wasteland with the help of tractors in the *bet* of the Jumna in Karnal District is under way since February, 1948. After reclamation the 'follow-up' cultivation of this land is also to be done by the Department of Agriculture, Punjab, for two years, after which, it will be released for cultivation by the refugees. This will enable the Department to recover the cost of reclamation and to raise sufficient quantities of seeds of improved varieties of crops for distribution

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among the cultivators. The *modus operandi* consists in first setting on fire the overgrowth which is mainly *sarkanda* (*Saccharum spontaneum*) and *jhaoo* (*Casuarina*) ; clearing up the stumps with the help of bulldozers and then ploughing it up with the help of D4-caterpillar tractors fitted with mould board ploughs. 'Follow-up' cultivation is then given and the land is ready for sowing. As a result of these operations, about 6,500 acres of land has already been reclaimed and bumper crops of *jowar* and *bajra* have been obtained and wheat sown over a large area.

Dairy Development Scheme

The Dairy Development Scheme is in operation since November, 1946 in the State. Under this scheme, one Dairy Development Officer, two Assistant Dairy Development Officers and 13 Dairy Development Assistants are rendering free technical advice to dairy enterprisers and milk producers. Proper guidance is given with regard to sanitation, cleanliness of milk-sheds, cattle stalls, hygienic milk production, viz. its collection, handling and distribution, advantages of keeping milk in clean, dry and modern dairy utensils, and also the desirability and advantages of feeding the dairy animals on balanced rations. As a result of the efforts of the staff, milk production and its export to towns has increased throughout the State. The total estimated daily increase in milk production in the State during October, 1949 was about 51 maunds and increase in milk imports to the towns from the villages about 177 maunds.

Agrarian legislation

With a view to giving a fillip to the 'grow more food' campaign, the State Government have put on the Statute Book, the following Acts :

The Punjab Pure Seed and Seedling Act : According to this Act the cultivators of notified areas are required to use the seed or seedlings only of improved varieties of crops. This would ensure higher yields, more uniform quality of the produce, and consequently better prices.

The Punjab Conservation of Manure Act : The Act requires the inhabitants of notified villages to pit their manure, sweepings and refuse, so that the plant food is not lost by exposure to rain, wind, sun, etc.

The Punjab (Amendment) Act to the Punjab Municipal Act of 1911 *:* This Act enjoins on the Municipal Committees to compost the town refuse, sweepings, night-soil, etc. before these are disposed of. This Act is meant at once to improve the sanitation of the towns and to conserve the plant nutrients for increasing the fertility of our famished soils.

The Punjab Agricultural Pests' Diseases and Noxious Weeds Act : Its aim is to eliminate all those agencies which reduce the quantity and detract from the quality of produce by their parasitic nature. The farmers of the notified villages are required to make concerted efforts to destroy the pests, diseases and weeds.

The Punjab Reclamation of Land Act : This Act empowers the Government to take for the purpose of reclamation culturable waste-lands.

The Punjab Consolidation of Holdings Act : It makes it compulsory for notified villages to consolidate their holdings and stop further fragmentation thereof.

In addition to the legislative measures mentioned above, a number of other enactments are in the offing. These are calculated to make the Punjab not only a self-sufficient, but a surplus State in respect of food production before the end of the target year 1951.

Across the Borders

RECENT ADVANCES IN ARTIFICIAL INSEMINATION

By JOSEPH EDWARDS

IN June, 1948, an International Congress on Artificial Insemination was held in Milan. It was the first of its kind and it provided an excellent opportunity to see how artificial insemination is developing throughout the world and the uses to which the technique is being put. There has been a vast change in the state of things between the outbreak of the war in 1939 and the present time, and the interest in comparing notes now lies in the fact that so many countries have made quite independent attempts, during the war years, to adapt the technique to their needs.

Reports to the Congress dealt almost entirely with artificial insemination as applied to cattle. (There was reference to very practical work with sheep in Argentina and Uruguay and to the usefulness of artificial insemination in bee-breeding). In the U.S.A., Denmark, Sweden, Holland and Great Britain this technique is obviously being used very extensively as an aid to livestock improvement. Estimates of the numbers of cows to be inseminated in these countries in 1948 are as follows :

U.S.A.	..	1,743,000
Denmark	..	600,000
England	..	350,000
Sweden	..	110,000
Holland	..	80,000

Rapid progress

Perhaps the most remarkable figures in the list are those for Denmark and England. For the former—where artificial insemination was begun in 1936—the number represents nearly 40 per cent of the dairy cattle population of the country ; those who still harbour doubts as to the effects of artificial insemination will reflect on the fact that the Danish dairy farmer is one of the best educated and most progressive in the world. The figure for England is remarkable because, although England had led the world in cattle-breeding and in the fundamental research (on the physiology of reproduction) that has made the artificial insemination technique possible, it made a late start (1942) in applying it. As will be shown later, the movement is gathering momentum at a rapid rate ; quicker, probably, than in any other country.

For a long time artificial insemination progress was slow because technical problems remained to be solved. It is now clear that, although the field of research in this subject is wide open and ripe for continued attention, the techniques now evolved are perfectly adequate for the livestock improvement job to be done. The collection of semen from the bull is well understood and more is known now of bull psychology, and of how to handle difficult or temperamental bulls, than at any time in the past. The practical problem of keeping semen alive in storage has been largely solved by the discovery of the value of egg-yolk as an addition to the diluting medium. At English centres semen up to three to four days old is in frequent use and the storage period may be lengthened still further if the recent Cambridge research work that has revealed the beneficial fraction of the egg-yolk, can be applied.

Current technique

The inseminating technique now in use in England, Sweden and the U.S.A. is essentially simple and is a vast improvement on earlier technique involving complicated instruments and a lot of time spent on the job. The inseminator holds the cervix in position (per rectum) with one hand and with the other guides the inseminating rod (glass or plastic) through the vagina into the uterus. The semen is deposited, and the rod discarded for sterilization before further use.

In the past three years the Milk Marketing Board Artificial Insemination staff has taught this technique to more than 150 men recruited largely from the ranks of milk recorders and herdsmen; the training period for each has been about one month, and to date only two men have had to be rejected for having failed to acquire the necessary standard of technique.

Organization of the service

Technical progress having been brought to a satisfactory pitch, it is now possible to devóte attention to organizing the best kind of service for farmers and to the all-important work of selecting the best possible breeding stock. It is in this field that Britain is making a notable contribution to progress, for the major part of the national development is being thoroughly integrated within the producers' own national organization—the Milk Marketing Board. The 160,000 farmers of England and Wales who produce milk for sale are members of the Board. (More than 100,000 of them have herds of 15 cows or less, and their interest in getting good bulls through artificial insemination is a vital one). Within the Board there is a Production Division which is responsible for the milk recording movement (National Milk Records), for the analysis of milk records, for studies of the inheritance of milk yields and butterfat, and the main environmental factors which influence them (the Bureau of Records), and for articificial insemination.

Recording services

Each year nearly 500,000 cows are recorded (on a standard lactation of 305 days) and their lactation yields are made available to the Bureau of Records. The Bureau services the artificial insemination movement in two important ways; it prepares extended pedigrees of bulls that are likely to be of use for artificial insemination and, more important, it accumulates progeny-records of bulls in service at artificial insemination centres (and in private herds) and indicates quickly the sires that should be used extensively and those that should be discarded.

It has been mentioned that England made a late start in applying artificial insemination to cattle-breeding. After pioneer centres at Cambridge and Reading had shown the way, the Government appointed a Central Advisory Committee in 1943 to advise on national development and to recommend the issue of licences of bona fide operators of artificial insemination centres. Personnel, and buildings and bulls for artificial insemination have all to be licensed by the Ministry of Agriculture. Bulls have to meet both livestock and veterinary requirements. The Government agreed to under-write artificial insemination financial losses over a five-year period, and up to March, 1950, and, through the Central Advisory Committee, keeps a close watch on how centres are run. The national insemination fee is 25 shillings per cow, and the success of the movement to date is such that it is likely to become self-supporting before the end of the Treasury grant period.

The Milk Marketing Board does not have a monopoly of artificial insemination development; there are six non-Board centres run by private and cooperative concerns and two by the Ministry of Agriculture. The Board has 15 centres in operation and a further 12 are to be completed. The sitting of centres was arranged to match the cow population of the country and on the estimate that on the average 40 per cent of the cows in an area would be inseminated. Since centres are limited to 30 bulls each, this estimate called for a centre for each block of 75,000 cows if the further estimate of 1,000 cows inseminated per bull per year were attained.

Estimating future requirements

It would appear today that these two important estimates, made relatively recently and on the best information available at the time, are likely to be fairly wide of the mark. It is already clear that in some areas the number of cows to be inseminated will be very much greater than 40 per cent of the population, but this is fortunately compensated for by the fact that, thanks to the American research work on semen dilution rates, the figure of 1,000 cows per bull may prove to be an underestimate. In 1947 Board centres used, on an average, a dilution rate of one part semen to 15-25 parts dilutor and the average number of cows inseminated was

975 per bull. (Five bulls were used to inseminate more than 2,000 cows each). It has recently been shown that dilution rates of 1 : 100 to 1 : 400 are possible, provided the inseminating dose contains five to ten million spermatozoa, and the effect of this extension of dilution limits, on numbers of cows per bull is obvious.

Each Board centre is supervised locally by a committee of farmers whose main task is to find bulls and to report on them and the way they are breeding. The purchase of bulls is carried out centrally (by the Production Division) and in this way unnecessary competition between centres is avoided. The part played by the Division in preparing and scrutinizing pedigrees for milk and butterfat inheritance has already been described.

Training personnel

A qualified veterinary surgeon is in charge of one or more centres and he has working under him teams of lay inseminators. The training of these men has been referred to. In addition, arrangements have recently been made for engaging young veterinary graduates on a temporary basis (one to two years), who will be attached to centres under the area control of the senior veterinary surgeon. In the artificial insemination service these youngmen will obtain valuable experience in all veterinary matters affecting bovine fertility. The extent to which lay inseminators should be allowed to function is in some countries an acutely controversial subject ; it can only be said here that the arrangement come to in England is proving to be very satisfactory.

The technical records kept at each centre are all-important ; they are comprehensive both as regards bull fertility and the fertility of members' herds. The centre staff does not undertake to deal with sterility problems but the records are always available to private veterinary practitioners and to the Sterility Officers of the Ministry of Agriculture.

The problem of sterility

The records show clearly herds—and even areas—in which sterility is a major problem, for the fertility of the bulls is always under observation and control and the source of the trouble can be indicated. In 1947 the average 'conception rate' for 64,000 cows was 64·4 per cent. (This rate is calculated on cows inseminated for the first time which, if they do not return to service in 90-120 days are assumed to be in-calf ; so that out of each 100 cows inseminated 64 hold to the first insemination). In a study of fertility in herds with 10 cows or more it was found that $22\frac{1}{2}$ per cent of the herds had a conception rate of 75-100 per cent, whereas, at the other extreme, 17 per cent had a conception rate under 50 per cent.

The farmers' enthusiasm

The most remarkable feature of artificial insemination progress is the keenness with which it has been adopted by the farming community. In spite of the fact that its name appears to emphasize the artificial or abnormal nature of the technique, there is no other application of agricultural science which has been accepted so rapidly. In England the number of farmers using the service has increased in $2\frac{1}{2}$ years from 3,000 to more than 30,000. (In June, 1948, Board centres alone enrolled 2,250 new members). This enthusiasm places great responsibility on those who have to find bulls for artificial insemination, which in turn puts the spotlight on the pedigree bull-breeding herds—their methods of breeding and the quality of bulls they produce. One result has been the formation of the 'British Cattle Breeders' Club'—a group of young breeders and scientists, more than 200 strong, who meet regularly to study applied genetics and the world literature on animal breeding. All breeds are represented in the Club.

Systems of breeding

Systems of breeding for use either in private herds or through artificial insemination have been the subject of much discussion. While there are several systems with which the private breeder may experiment, it appears that for some time to come the safest breeding policy for the artificial insemination movement will be simply the use of the best bulls that can be found. The emphasis will be on progeny-tested bulls and much attention is now to be given to finding them and to bringing about refinements in interpreting the tests (e.g. the allowance that

should be made for environmental influences). The Danish artificial insemination movement is making good progress with its 'Progeny Testing Stations' where groups of 20 daughters by artificial insemination bulls are tested for one year under standard conditions. If 5,000 or more daughters are to be sired each year by one bull it is almost impossible to over-emphasize the importance of finding, as exactly as possible, the transmitting value of the sire.—Reproduced from the *British Agricultural Bulletin*, Autumn 1948.

CATTLE BREEDING

A CATTLE improvement scheme known as 'Key Villages Scheme' has been launched in Uttar Pradesh and Cochin. According to this, all bulls of inferior type will be castrated in these selected areas and high quality bulls supplied in their place, thus improving the quality of cattle. A third such scheme will be in operation in Delhi shortly.

Some of the sheep breeding schemes have shown interesting results. For instance, the Madras scheme has shown that the quality and quantity of wool produced by Bellary sheep can be definitely improved by feeding the sheep on good pastures. Commercial samples of wool from various centres have been collected for the purpose of fixing standards for the Indian wool. A suggestion made in this connection is that India can be made self-sufficient in the matter of wool supply by an intensive programme of selective breeding and cross breeding of indigenous sheep with Merinos.

FOOD FROM THE SEA*

By GORDON A. RILEY

NO one needs to be told that there is a great deal of life in the sea. Sweep the shallows with a fish net, explore the deeps in a diving bell, dip up but a cupful of ocean and examine it under the microscope—at every level, the watery world swarms with a rich and varied population. But only recently have land inhabitants begun to understand just how vast this population is. Even fragmentary efforts to take a census of it indicate that the life of the sea actually surpasses that of the land.

Man has hitherto taken his food almost entirely from the land ; less than one per cent of what he eats comes from the sea. We would like to believe that in the immense, newly explored organic resources of the oceans lies at least part of the solution to the world's increasingly acute food problem. At this moment, however, no one can accurately assess the potential marine food resources. Large areas of the oceans are still relatively unexplored from the biological point of view. A recent international conference of fisheries experts called attention to the fact that increased fishing effort on the major fishing grounds of the North Atlantic had not increased the catch ; indeed, some biologists believe that these grounds are now being overfished. Moreover, there are technological problems and unpredictable economic factors that will have an important bearing on how much food we can feasibly get from the oceans. Yet, with all these cautious reservations, we are justified in taking a hopeful attitude toward the possibilities.

The hierarchy of life in the marine world, like that in the terrestrial world, is founded on green plants. They alone have the ability to convert inorganic materials into living substance and, directly or indirectly, they support the whole animal population.

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*Reproduced from *Scientific American*, October, 1949.

This system by which organic matter is created by the photosynthesis of green plants, consumed and broken down by animals, and recreated by plants is essential to the continued existence of any population, on land or in the sea.

At the base of the oceanic heirarchy is a vast mass of organisms so tiny that they are individually invisible. More than 99 per cent of the marine plants are microscopic, one-celled algae which have a precarious and nomadic existence. They are suspended in the surface waters of the sea and drift idly with the currents. To the naked eye, they are visible only as a greenish or brownish tinge in waters where they are abundant. Under the microscope, they are resolved into great multitudes of organisms, ranging from a thousand to several million in a quart of sea water. They add up to a total of perhaps a hundred pounds of plant organic matter for each acre of ocean.

Associated with the plants is a great variety of small animals. Some spend their whole lives drifting in the surface waters. Others stay with the floating population only until they are grown and then strike off on their own. Not all the animals in this population are plant eaters, however ; some prey on smaller animals.

The floating plant and animal society is known collectively as plankton. It provides food for a host of larger and more active creatures that live in the surface waters, including such fish as herring and mackerel. In coastal waters and the offshore fishing banks, plankton sinking from the surface nourish the small animals that live on or near the bottom. These, in turn, are the food of flounders and other ground fish.

Thus, the fishes and other large animals in the sea represent the end product of a long and complicated food chain. Through a series of predations, the tiny bits of plant life are transformed into successively bigger bundles of living material. But all along the way from plants to fishes, there is a continual loss of organic matter. During its growth to adulthood, an animal eats many

times its own weight in food. Most of the organic material it consumes is broken down to supply energy for its activity and life processes in general. It follows that the total of plant matter in the sea outweighs the animals that feed upon it, and the herbivores in turn outweigh the carnivores. Fish production is believed to be of the order of only one-tenth of one per cent of plant production.

The investigation of the amount of organic production in the sea is one of the most difficult and fascinating problems in biological oceanography. In the broadest sense, it means determining the rate of production at every level in the food chain. It also means investigating the tangled oceanographic and biological relationships that determine the productivity of any given region.

The Norwegian investigator, H. H. Gran, filled bottles with sea water containing its natural plankton population, suspended them in the sea so that they would be exposed to reasonably normal conditions of light and temperature, and measured the growth of plankton that occurred during a period of a day or two. To measure the production of organic matter, he divided the bottles into two groups. One group he wrapped in dark cloth ; by excluding light, he prevented the process of photosynthesis, and, in these bottles, the plankton did not produce organic matter but only consumed it. In the lighted bottles, on the other hand, both production and consumption went on, just as in the sea. The difference in the organic content of the two sets of bottles showed the total amount of organic production.

Several hundred such experiments have now been made : by Steemann Nielsen in Danish waters, by the writer in the western Atlantic, by M. C. Sargent of the Scripps Institution of Oceanography in California coastal waters and the tropical Pacific, and by others. In most of the regions examined, the sea yields from one to three tons of dry organic matter an acre every year. This means that, on the average, the plant population must grow about 10 per cent a day. The most fertile areas of the ocean have approximately the same annual production as a forest. The lower limits of productivity correspond more nearly to the grass crop of a semiarid plain. Thus acre for acre, the plant production of the sea and of the land is of the same order of magnitude. But, because of the larger area of the sea, its total production is almost certainly greater.

The production of animal plankton has not been studied as thoroughly. The animal crop is from one-tenth to one-half of the plant crop. But the animal production cannot yet be estimated with a satisfactory degree of accuracy.

Fish and other animals at high levels of the food chain have a much slower growth rate than plankton. Several years ago, Daniel Merriman and his associates on the staff of the Bingham Oceanographic Laboratory of Yale University in the United States began an intensive study of the flounder fishery off the southern New England coast. According to their findings, annual production of fish approximately equals the population at any one time. The average plant population in the area studied appears to be about four times the weight of the fish. But it grows much faster ; the annual plant production is over 500 times the annual fish catch. Similarly, the Woods Hole Oceanographic Institution and the U.S. Fish and Wildlife Service found that on Georges Bank, a large and important fishing area east of New England, annual fish landings ranged from 7 to 33 pounds an acre, while phytoplankton production was estimated to be of the order of a thousand times the maximum commercial catch.

These studies of marine productivity are a step along the way toward two goals that oceanographers have in mind. One is purely scientific—to gain an understanding of the principles that govern the existence and growth of marine plants and animals. The other is to apply this knowledge, wherever possible, to practical affairs.

What are the factors that control the sea's productivity ? In a general way, we know some of them. We know that light and temperature strongly affect the growth rate of the plants, and temperature also influences the rate at which these plants sink to deeper levels and the rate at which animals feed on them. Currents and accompanying turbulence in the water are important : if the turbulence is too great, it slaughters the surface population by carrying plants down below the zone of active growth ; if the turbulence is too weak, the population again

suffers because less phosphate and other food is brought up from below.

The best fishing areas are generally in shallow water. There the plant population is concentrated in a small space, and the animal plankton can feed intensively and grow rapidly. There, also, an abundant supply of plankton falls to the bottom and nourishes the animals that live there. In deeper waters, the dead plankton decomposes as it sinks, and little reaches the bottom. This is one reason why on a deep ocean bottom animal life is scanty.

During the past few years, the writer and his associates have made preliminary attempts to deal with plankton in mathematical terms. An equation can be written to predict the quantity of plankton in a given region or its seasonal changes on the basis of the environmental characteristics of the region—light, temperature, turbulence, the depth of water, and the deep-water concentration of nutrients. Unfortunately, present knowledge of these subjects is not nearly as precise and complete as might be desired. Nevertheless, in various regions where the equations have been applied, the quantities of plankton predicted agree with observations within about 25 per cent.

Predictions of one kind or another will be a major function of the practical oceanographer of the future. It will be necessary also to consider controls to prevent overfishing, which endangers the production of young. Even when we have solved the problems of fish conservation, however, there will remain the challenging fact that we still will be using only a tiny fraction of the total organic production of the sea.

One way to increase our harvest is by intensive oyster and clam farming. These animals exist at a low level in the food chain, living on small plankton and detritus. Production is, therefore, relatively efficient. In the Philippines, the East Indies, China, and various other regions, considerable success has been attained in farming fishes and prawns. When shallow coastal areas are impounded and artificially fertilized, the increase in production is sometimes twentyfold. Annual yields of 4,000 pounds of fish an acre have been reported. Development and extension of fish culture in both marine and fresh waters is undoubtedly one of the best approaches toward remedying the protein deficiency of the Oriental diet.

We can certainly learn to use fish more effectively and catch them farther afield. There are vast fishery resources in various parts of the world that remain virtually untapped. Changing economic patterns and increased demand may lead to the development of such resources. Quite possibly, the world's fish catch could be increased at least five or ten times.—Released through *U.S.I.S.*

Home Gleanings

SHEEP NUMBERS AND THEIR SIGNIFICANCE

By H. K. LALL

THE cattle 'numbers' have received great attention recently because of the important part, they play in the agriculture of the country, and rightly, because without knowing the numbers, which help in finding out the requirements and setting up of targets, no future developments can be planned. The sheep, which occupy no mean place in our agriculture, have not received the same attention. The industrial importance of sheep is considered to be one of the oldest agricultural enterprises. The word sheep has ancient origin and is represented by terms of Aryan languages, which are derived from the Sanskrit word 'Avi' signifying 'to guard'. This indicates that sheep were highly valued in ancient times as they were designated by the name which meant that they were required to be carefully guarded.

So far sheep breeding has been to a great extent in the hands of nomadic classes, through whose agency it is difficult to make any sustained effort towards improvement, but even then, this industry, which has been in the hands of the poor people, has not received the same attention as the industries like the cotton which is owned by the richer classes. Very often, it is not realized that sheep are a media that provide us with wool, meat, manure, milk, butter, pelts, hairs and serve as pack-animals in some of the hilly tracts. Wool alone, that is produced in the Dominion of India, is valued at about Rs. 5·5 crores. In case of wool too, whatever attention has been given, it has been aimed towards the industrial aspect of the problem, rather than, improving the management, breeding and feeding of sheep.

big gap

the provinces and States in India have not taken the sheep census regularly and, therefore, there is a big gap in our information. Again, the accuracy of the methods of enumeration, at the time of census has been questioned because of the doubtful factors that come in, at the time of taking the census. The information is also incomplete in many other respects. For instance, separate figures for young-stock, adult male and adult females, or for hairy or woolly sheep are not available in many cases. Nor are any figures available separately for various breeds, which is so essential to assess *accurately* the amount and type of wool that can be produced in the country. Many of the calculations of the types of the wool produced in the country are based on estimates only. In sheep-conscious countries, the sheep population is estimated or in some cases enumerated each year to gauge the progress of the industry and to regulate the trade accordingly. It would be just as well, if a similar procedure was followed here, after a process of estimation, applicable to this country, had been found. To overcome the various difficulties in the taking of census and to have more complete information, new procedures are being suggested by our Statisticians for the 1950 census as far as human and cattle populations are concerned, and it is desirable that sheep should also receive the attention they deserve, and all the relevant information as regards sheep population is collected by the adoption of sound methods.

The figures from the provinces, where census has regularly been taken, have been analysed for 1920 and 1945, i.e. for the last quarter of the century. The total figures for British India have also been compared with those of the important wool producing countries of the world.

TABLE I

Sheep population country-wise

Country	Year of census					
	1920	1925	1930	1935	1940	1945
U.S.A.	40,743,000	38,543,000	51,565,000	51,808,000	52,399,000	47,780,000
U.S.S.R.	98,100,000	112,780,000	52,960,000	54,200,000	93,000,000	**63,400,000
Canada	3,027,000	3,431,000	3,492,000	3,399,000	2,653,000	2,822,000
U.K.	21,212,000	24,053,000	25,263,000	24,243,000	26,319,000	20,150,000
Australia	85,556,000	103,329,000	111,417,000	113,048,000	119,305,000	105,415,000
New Zealand	23,382,000	27,516,000	28,793,000	29,077,000	31,063,000	33,975,000
Indian Provinces*	22,705,000	24,167,000	26,817,000	25,121,000	29,132,000	22,944,600

*British India Provinces

**1943

TABLE II

Percentage increase in sheep population as compared to previous censuses

Country	Year of census				
	1925	1930	1935	1940	1945
U.S.A.	−5·4	+33·8	+0·5	+1·1	—8.8
U.S.S.R.	+25·2	—56·9	+2·3	+71·6	−31·8 (1943)
Canada	+13·3	+1·8	—2·7	—21·9	+6·4
U.K.	+13·4	+5·0	—4·0	+8·6	—23·4
Australia	+20·8	+7·8	+1·5	+5·5	—11·6
New Zealand	+17·7	+4·6	+1·0	+6·8	+9·4
Indian Provinces	+ 6·4	+11·0	—6·3	+16·0	—21·1

It will be seen from the 1945 census, that the sheep population almost in all the countries went down except in New Zealand and Canada. There is a decrease of 8·8, 31·8, 23·4, 11·6, and 21·1 per cent in the U.S.A., U.S.S.R., U.K., Australia and India respectively, while there is an increase of 6·4 per cent of Canada and 9·4 per cent in New Zealand. It may be mentioned here that though India possesses 6·7 per cent of the total world sheep population, yet the wool production is less than 1·5 per cent of the world production.

In the case of India, it is observed that there was an increase of 6·4 per cent in 1925, of 11 per cent in 1933. This was followed by a decline of 6·3 per cent in 1935 and an increase of 16 per cent in 1940, while in 1945, i.e. in the last census, there is a general decrease of 21·1 per cent. The trend of rise and fall of population in all the provinces is more or less the same except in the small provinces of Assam, N.W.F.P. and Ajmer-Merwara, which register an increase in 1945. This, probably, is owing to the influx of population from the neighbouring border areas and States owing to the increased demand for animals for meat. It is diffcult to judge the absolute significance of these figures without knowing the exact population of the States, which possess large number of sheep, specially because th sheep population in many areas speady in Rajputana (Western Desert) is r

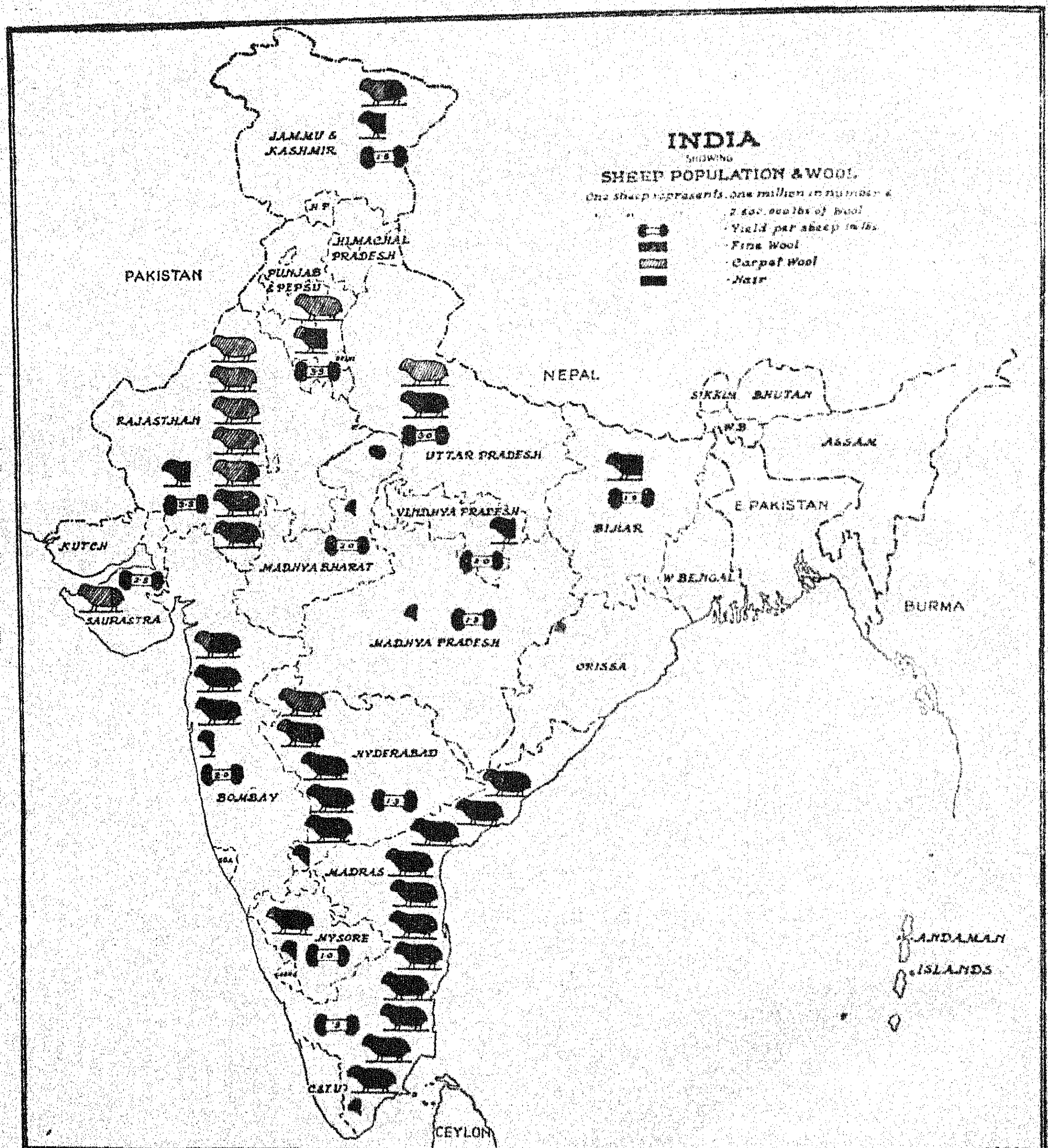

FIG. 1. Sheep population and wool.

and keeps oscillating, depending on the conditions of the pastures. This, of course, is one of the reasons why sheep are reared by nomads and not by permanent settlers.

Factors affecting sheep population

The decline in 1945 is apparently due to excessive slaughter on account of increased demand of meat for the army. Some of the economic factors over which the sheep farmers have no or very little control, and which contribute towards the general deterioration of sheep industry are drought, diseases, wild animals, fluctuating prices of mutton and wool, uneconomic holdings and soil erosion. A detailed study of these factors and their exact repercussions however can only be determined by studying the problems in small areas, because in the study of the population over large areas, the effects of one or more of the factors, are masked by the others, as several of them are in operation at the same time. Nevertheless, it is well known, that soil erosion in grazing areas, which are limited in this country, has been on the increase, and there has been greater incidence of disease during the war because of the increased movement from one province to another. These factors must have played an important part in the reduction of sheep population though the major factor, as stated above, seems to be excessive slaughter during the year.

Number as well as quality

A serious view of this decline in sheep population has to be taken if the country has to be made self-sufficient in wool. Not only the depression has to be stopped but steps have to be taken to increase the number as well as the quality in a reasonably short period.

Most of the wool produced in the country is carpet wool (Fig. 1), a considerable quantity of which (about 31 million lb.) is exported abroad. Some fine wool is also produced in the country most of which comes from Kashmir, South-East Punjab, Western U.P., Rajputana, Kathiawar and Mysore. In addition large quantities are imported from abroad for use in Indian mills. One of the estimates is that the Indian Union excluding States produce six million pounds of fine wool. On the average of three typical years before the war, India as a whole imported 11·1 million pounds of fine wool, the share of the Indian Union on this basis being nine million pounds. The panel for Woollen Textiles has recommended the stepping up of woollen production by at least 60 per cent, and keeping this into account the total requirement for the Indian Union comes to 14·4 million pounds. To reach that level obviously, a lot of more fine wool has to be produced. This can evidently be done if more and better sheep are produced. At present the yield of Indian sheep is less than one-third or even one-fourth of the sheep in Australia, New Zealand and the U.S.A., the fine wool producing countries. It is, however, encouraging to learn that as a result of the experiments carried out by the Indian Council of Agricultural Research, it has been observed that a number of Indian breeds have the potentiality for producing fine wool, that can be developed by the process of selective breeding, which however, is a time-consuming process. To attain our targets, therefore, methods, such as cross breeding with foreign fine-wool sheep, such as Merinos, will also have to be adopted. But to give momentum to these suggestions, an organization, similar to that existing for research and development of cotton and jute is a *sine qua non* for placing the wool industry in its rightful place. Needless to say that such an organization will also render the much needed fillip to this cottage industry.—Reproduced from *Rural India*, August, 1949.

Book Reviews

THE QUESTION OF ESTABLISHING UNITED NATIONS RESEARCH LABORATORIES

United Nations Publication, United Nations Department of Public Information, Sales and Circulation Section, Lake Success, New York, 1949, pp. 290, $ 2.00.

THE Economic and Social Council of the United Nations Organization adopted sometime ago the following resolution :

1. That a certain number of research activities can only be carried out in efficient manner on an international scale, and

2. that many branches of scientific research connected with the promotion of human knowledge, particularly in the field of public health, would yield considerably more effective results if they were conducted on an international plane.

Invites the Secretary-General to consult UNESCO and other specialized agencies concerned and to submit to the Economic and Social Council, if possible during the next session, a general report on the problem of establishing United Nations Research Laboratories.

The results of this investigation have been embodied in the report which has been published under the title *The Question of Establishing* United Nations *Research Laboratories.*

Certain principles have been laid down for selecting problems where international co-operation in research would yield results of considerable value. These are noted below :

Principle of ripeness of problem : Studies where a large concentration of financial resources in a coordinated project is likely in a short period to yield important results which would not be otherwise achieved for many years as problems pertaining to researches on cancer, tuberculosis, analysis of data on human biology, institute for study of individual and social psychology.

Principle of remoteness of subject matter : Problems which have to be studied on the spot, and remote from many centres of research and transcending national boundaries come under this head ; for example Tropical diseases, Nutritional deficiency in tropical and temperate Asia, Astronomy and Meteorology in Southern Hemisphere, Himalayan High Altitude laboratory, etc.

Zonal principle

Zones of earth : Research on problems on world's climatic zones—the polar (Arctic and Antarctic) the arid, and the humid tropical zones—where both principle of remoteness and transcendence of national boundaries come into play.

Principle of transcendence of national boundaries : Investigations on locusts, migration of birds, etc. come under this head.

International pools : Concerning themselves with the establishment and preservation of International standards which are beyond any single or national or private research institution ; collection of type cultures, storing up of pure chemicals not commercially obtainable, new chemicals like transparent resins, radio active isotopes, etc.

The following extracts from a note submitted to the UNO by Prof. Pierre Gourou, Department of Geography Université Libre, Brussels, Belgium may interest readers of *Indian Farming :*

'Under-water crops (which are not the same thing as irrigated crops), particularly the growing of rice make it possible to avoid the catastrophies of soil exhaustion, erosion, laterization. Protected by a sheet of water the soil does not deteriorate, and may yield satisfactory harvests year after year. Even if it is badly manured, it repays human effort. The dense population of tropical Asia therefore depends completely on under-water rice growing, which appears to be the happiest solution of the problem of producing cereals in warm and rainy countries. The densely populated regions are less material than others........Wild nature had to retreat to make way for humanized nature. In particular the under-water rice fields with their stagnant water do not provide favourable

conditions for the larvæ of the dangerous anopheles mosquitoes, which prefer clear, fresh and sunny water. In tropical Asia men have unconsciously reduced the danger of malaria, thereby creating more favourable conditions for the development of a dense human population.'—(J.C.G.)

PESTS OF FARM CROPS

By J. S. Stapaley. Agricultural Series, edited by Prof. S. A. Saunders (Published by E. & F. N. Spon Ltd., London, 1949, pp. 325, 21s.

PUBLICATION of handbooks on pests of farm crops is essential in all countries in order that the common cultivator may derive benefit from the results of work carried out in Research Institutes. Mr. Stapaley's book is one of this kind. It is written for the use of English farmers particularly those residing in the eastern counties of England. Mr. Stapaley has included in his book a certain amount of information which will be useful also to students of agricultural colleges in that country. Of course extension and advisory staff of agricultural departments will also find the book handy.

It is, however, not understood why some important pests such as rabbits, rats, etc. have been excluded from the compass of the book. It is well known that these pests cause considerable damage and it would have been useful to the farmers if they could find an account of all important pests in one handbook. It will also be noted that the account of pests has been arranged in a systematic manner, e.g. the pests belonging to a particular group such as Orthoptera or Rinchota are described together irrespective of the crops which they damage. In our view a book written primarily for the farmers should give account of pests cropwise. The farmer who cultivates potatoes or wheat will prefer to have an account of all important pests in which he is interested at one place for ready reference. Unfortunately, in the book under review he is likely to encounter considerable difficulty in tracing the account of pests with which he is most concerned not knowing the scientific groups to which they belong. Another serious omission in the book is absence of any discussion of spraying and dusting machinery. It is now well known that the effect of insecticides not only greatly depends on the spraying machinery which is used but also on its small but essential parts such as nozzles, etc. The technique of spraying operations is also important. Such an account of machinery would have been extremely useful if it had been included in the chapter dealing with Methods of Pest Control.

So much advances have been made on new synthetic insecticides (DDT, BHC, etc.) during the last two or three years that their account in this book is already out of date. This was visualized by the author himself but apparently the book has remained in the press for about three years since the author wrote the Preface.

By above criticism I do not intend to underrate the value of the book. It is sure to prove useful to English farmers because in scientific knowledge of crop pests they are much in advance of their fellow workers in the tropical and sub-tropical countries. (H.S.P.)

PIGS

By J. W. Reid. Published by Farmer and Stock-Breeder Ltd., E. & F. N. Spon Ltd., London, 1949, pp. 208, 16s.)

THE book is based on lectures given to students at the Hertfordshire Institute of Agriculture for over a period of 20 years. The first five chapters deal with the history of the organization of pig industry, including marketing, in the United Kingdom, the trends of trade of piggery products, e.g. bacon, pork, etc. between the United Kingdom and the continent during the last century and the economic aspects of the industry. The details of capital requirements have limited applicability elsewhere, as they pertain to conditions obtaining in the United Kingdom.

The sixth chapter deals with the effects of war on the pig industry in the United Kingdom. The general principle of pig

keeping, selection of pigs, their breeding, housing, feeding, management, etc. are discussed in the other chapters. A short description of the methods of slaughtering and processing of piggery products is also given and this adds to the utility of the book. Pig diseases are also briefly described. It would have been perhaps better to describe the diseases in the order of their importance in the United Kingdom.

The book is written in a lucid style, easy to follow. This may be illustrated by reproducing the lines explaining inbreeding and line breeding :

'Where very closely related animals are mated, e.g. father to daughter, son to mother, brother to sister, it is termed inbreeding ; where the degree of relationship is wider, e.g. cousin to cousin, uncle to uncle, it is termed line breeding'.

The book contains information on the breeds and population of pigs in other countries, but in these India has not been included, probably because no authentic records of pig population are easily available in this country. (H.K.L.)

MECHANICAL SCREEN FOR COMPOST MAKING

A MECHANICALLY operated screen for sieving town refuse, capable of turning out a ton of finished compost at a cost of Rs. 1-7 only has been designed at the Indian Agricultural Research Institute, New Delhi. The screen is worked in conjunction with a tractor-operated-loader which can discharge approximately 10 tons of material per hour into the screen. An elevator which enables the finished material to be loaded direct into waiting trucks or carts has been fixed with the screen so that at none of the stages of operation, manual labour would be necessary to handle the refuse.

The mechanical screen needs only seven men to prepare six to seven tons of finished compost per hour.—*P.I.B.*

News and Views

NEED OF PROPER UTILIZATION OF FOREST WEALTH*

I MUST apologize to you all for my inability to address your Convocation personally, as I had been looking forward to. When one is caught in the whirlpool of overriding official engagements the fundamental rights of freedom of movement and of personal liberty have perforce to be suspended and, unlike the ordinary citizen, the victim has no forum to which he can have recourse for redress. I am sure, therefore, that all of you will sympathize with me in the circumstances which have compelled me to deny myself the pleasure of meeting you and sharing with you a few thoughts and ideas. I need hardly tell you that if you suffer from a sense of disappointment, mine has deep regret mixed with it.

The Forest Research Institute of Dehra Dun is no stranger to me. I have already had glimpses of its work. Its sylvan setting, its picturesque walks, its ideal surroundings, have all attracted my attention during my prolonged stay in Dehra Dun both last year and the year previous. I have also closely seen the rich collection of its museum and have acquainted myself, through some study and contact, with the work that is being turned out within its premises. Yours, friends, is an old Institution, almost as old as myself. Its history shows how from small and humble beginnings 72 years ago, it has changed its character and widened its scope until today when it is the nursery of all that is best and useful in forest service and a laboratory from which are turned out valuable research products in a vital field of national enterprise.

It is no facile or facetious compliment that I am paying Forestry when I refer to it in the terms I have done. Forests, as natural resources, are the most wronged by the hands of men who should appreciate their utility better. In the struggle for existence or in competition with nature, human beings are apt to follow the path of least resistance and taking a narrow short-term view of their needs and the resources available for their fulfilment, lay their hands on the nearest available resource without any forethought of their replacement for future requirements. The history of denudation of the forest resources of this country is replete with instances of cruel exploitation of this vital national wealth and criminal waste of capital placed in our hands by a bountiful Nature. Planned exploitation of such resources, based on the principle of preservation and replacement, is a feature of comparatively recent date. Obviously, we cannot make up the leeway of centuries, but we can by judicious planning and lay-out still husband the resources that are available and create wealth which, in course of time, may achieve that balance between afforestation and clearance which is the hall-mark of scientific planning.

After all, forests satisfy our basic needs with a universality which might well be the envy of those who believe in bringing wealth within the reach of all. The humble dweller of village huts, the rich dweller of luxurious city buildings, the cook in his kitchen and the more fortunate possessor of a well-furnished drawing room, all alike draw from the forests the means of satisfying what to each is an elementary and essential need. But how few have the attitude of reverence and consideration for the trees and plants that sacrifice themselves in the service of mankind? Worship of trees is still an old tribal or village custom. We ourselves in our cosy chairs touch wood to invoke blessings or to ward off the evil eye. In one case there is the sense of closeness to a readily available aid for existence; in the other, there is a recognition of value forced by habit rather than by conviction. But in both there is the element

*Address of the hon. Sardar Vallabhbhai Patel on the occasion of the Convocation of the Forest College and the Forest Research Institute on 2 April, 1950.

of sanctity which needs greater realization and genuine appreciation in every-day life.

Applying these thoughts to realities and hard facts of statistics, I find that the total forest area of this country covers 171,000 sq. miles which gives a percentage of 22·6 to the total land area. If we consider the requirements of our vast population and the need for softening the rigours of its climate and combine this with a study of the distribution of the area under forests and the comparatively poor state of our communications, we shall at once be struck with the deficiency of the resources that are available. At a conservative estimate, in order to have a balance between open and covered area, we must add at least one-third more to our area under forest.

We have also to consider another broad fact which has recently been claiming increasing attention. Do not the failure of monsoon on the East Coast during the last three years, the fitfulness of monsoon in North Gujerat and Saurashtra and the encroachment which the desert of Rajputana is making on the Gangetic plain suggest the need for so ordering our forest belts as to create conditions more helpful to averting what might eventually be a certain disaster to the life and happiness of millions? The part which forests play in moderating the rigours of climate and meeting the growing menace of the desert or the trespass of the rivers and mountain streams on fertile soil can hardly be overestimated.

The existence of mounds and ridges where, only some years ago, there were green pastures of smiling crop-lands, the surrender which cultivation has been making to barrenness, and the presence of bare rocks where years ago the sylvan goddess stood in all its splendour, should convince us of the heavy drain which is slowly but surely being made on our priceless treasures on which depends our ability to feed our growing population.

If we are to survive this growing struggle for existence, this process of denudation of our wealth has got to be stopped and we have to plan a nation-wide scheme of afforestation which would provide against the dangers to which I have referred above. To neglect this essential field of nation-building activity would be a national disservice and a failure to discharge a vital duty of administration and citizenship.

I realize that simultaneously a system of scientific exploitation of our rich timber resources must go on. The total revenue from forests in former provinces alone amounted to about Rs. 10½ crores and the total outturn of timber and firewood amounted to 1/3 and 5 million tons respectively. Moreover, forests, while saving us from the ravages of flood and famine, can themselves become a menace to cultivation. Scientific felling of forest areas combined with fresh growth, which would at least make up for the loss of forest wealth involved, must be the aim of a sound working plan. Forests also provide indispensable raw material for important industries, both big and small.

The proper utilization of forest wealth must, therefore, be an important part of our national policy, if we have to succeed in increasing national prosperity, but here also our watchword should be that we create more than we destroy and turn all our uncultivable area capable of being brought under the plantation into lands yielding either valuable forest wealth or performing the useful function of sentinels against the forces of elements, water, weather and sands.

Friends, I am afraid I have now wearied you with a few thoughts which struck me as being germane to the pleasant duty of addressing this gathering of accomplished and budding experts in forestry. There has been a constant rivalry between the expert and the layman ever since the dawn of history. It was an irate layman belonging to the bewigged variety, who divided witnesses into three categories 'liars, damned liars and experts'. I shall not be so judicial for a politician has to be judicious and shall at once recognize the value which experts have in every department of human activity. I also realize my own limitations; the expert must begin where the layman ends and, if necessary, help the layman to carry on. Even as a professional I was and remained only a lawyer; may be for some Magistrates and Judges I was a 'damned lawyer', but unlike my expert friends I stopped there. I hope, therefore, you will bear with me for a while, if I place before you the layman's demands on the expert.

The common man must be scientific if he has to make a success in life. The virtues of precision, of logic, of a careful understanding of causation and effect, and of scientific imagination, criticism and analysis must be cultivated in his own humble way by an average citizen. Without the elements of these virtues, the average man cannot fulfil adequately the role, which he must, in the exacting field of democracy.

The role of the expert in any form of Government, except that of experts, is also equally, if not more, exacting. Knowledge shines best when scholarship is combined with humility. With the limits of knowledge undefined and undefinable, an expert is no more than a child gathering pebbles by the seashore. The expert or the technician has also to be tolerant of the faults and shortcomings of persons less equipped than himself. It is no use his carrying on a store-house of knowledge with him, if he cannot make those who are going to utilize it, understand its potentialities and utility. He must, therefore, treat others not with condescension but with consideration and with a view to converting and not merely controverting.

The instruments of experts are the men of the 'humbler lay' and they cannot, therefore, afford to quarrel with their own instruments. Similarly, it is the common man and their problems that must afford an expert opportunities for testing and putting to practical use his technical knowledge and ability. My appeal to you, who are now entering the threshhold of their career in public service, is to regard your service as a field of duty and not as merely an opportunity for a career, to treat the common man with sympathy, understanding and consideration, to make him realize his shortcomings and put faith in your knowledge and ability and then to place at his service unreservedly and unstintedly all that is best in yourself. It is only then and in this spirit that the common man will extend to you that confidence and trust without which your own true mission in life cannot be a success that it deserves to be.

Also please remember that the resources of the State are limited ; you owe it to the country to achieve the maximum at minimum cost. It is good to have sometimes your heads above in the clouds but never lose the grip on Mother Earth. Trailing clouds may lend you their glory but they will be driven away by the mildest breeze whereas even in a blast, the firm ground below will give you foothold. After all stability is essential for success in life and without it even a genius cannot make good in this world.

Friends, I now come to the last and most pleasant duty which I would have been more than delighted to perform personally today. It is to congratulate all those who are the proud recipients of diplomas after a successful completion of their courses. They have had the satisfaction of their labours being rewarded. I only hope and pray that their labours in the service of the country will be equally successfully rewarded. I also congratulate your President and members of the staff on the successful closing of one more year in the life of this great institution. May this Research Institute grow in stature, in service, and in usefulness as it completes its spans from year to year !

I shall now close with one more word of apology for my failure to fulfil this engagement and a word of gratitude for the kindness with which you have tolerated this lapse of time. Jai Hind.

I. C. A. R. STUDENTS' EDUCATIONAL TOURS

By V. N. AMBLE

STUDENTS of the training courses in Agricultural Statistics conducted by the Council of Agricultural Research are taken on educational tours to visit some of the important experimental stations in order to acquaint them with the practical applications of statistics to agriculture and animal husbandry. A brief account of the visits paid this year to the Institute of Plant Industry at Indore, Government Veterinary College at Mathura and the Indian Veterinary Research Institute at Izatnagar is given in this note.

The Institute of Plant Industry at Indore is one of the foremost among the research centres in the country at which statistical methods are applied with advantage to agricultural experimentation. It was here that the modern technique of plant selection through progeny-row trials was developed and a remarkable advance made in the theory of inheritance of quantitative characters. A visit to this Institute has appropriately become an annual feature for the Diploma students, who make a special study of the applications of statistics to genetics.

The visit took place in the month of March and lasted ten days. The students were taken round the farm, and the Sections of Botany, Agronomy, Plant Pathology and Entomology, and shown the farm operations as well as the field and laboratory experiments in progress. The genesis and objects of the different experiments were explained to the students and the layouts and the proper mode of statistical analysis of the results were discussed. On-the-spot discussions of field trials brought home to the students several points of a practical nature which should be attended to in designing experiments. In addition the students had the benefit of a refresher course of lectures on genetics and plant breeding from Dr Panse, the Director of the Institute, in which he dealt with the salient features of the subject and indicated the scope for further research in its development. The research workers of the Institute gave in turn a resumé of the problem engaging their attention and a general discussion followed which helped to stimulate the interest of the students. The brief visit was highly instructive and thoroughly enjoyable.

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While the senior students were busy at Indore, the students of the Certificate and the Applicational Courses paid a visit for a couple of days to the Veterinary College at Mathura. The College, started a few years ago, is developing rapidly and close to the College is the Livestock Research Station of the Government of Uttar Pradesh. The students were shown round the different sections of the College as well as the Research Station at which research was at present being carried out mainly on animal genetics. Experiments such as the one on the study of the effect of hormones on milk yield and another on the effect of seasonal variation on the productive capacity of animals attracted attention of the students. When the Animal Nutrition Section now located at Bharari is also shifted to Mathura, the Research Station would be having its full complement.

Later on both the batches together went on a short tour of three days to the Indian Veterinary Research Institute at Izatnagar, which, as is well-known, is the principal centre of research in India in animal science, including animal genetics and breeding, animal nutrition and the study of animal diseases and pests. The students were taken round the various sections and were given an idea of the nature of the problems that were being tackled. Among these special mention might be made of nutrition experiments like digestibility trials, animal physiology experiments, experiments relating to problems in artificial insemination and poultry breeding plans. This visit as well as the one to Mathura was especially beneficial in revealing to the students the vast scope that statistics had and the useful role that it could play in animal experimentation.

FIFTH SESSION OF THE FAO CONFERENCE

HOW well fed, clothed, and sheltered are the people of the world today? How can the nations, through individual and joint action, improve the world food and agricultural situation?

These were the two main questions that the FAO Conference asked at its Fifth Session, held in Washington, D.C., from 21 November to 6 December. All Conference activity referred directly or indirectly to these questions.

The Conference answer to the first question states the world problem of food and agriculture today. The Conference answer to the second question constitutes a plan and a programme for FAO and suggestions and recommendations to member governments on food and agriculture policy.

According to the picture presented to the Conference, total world agricultural production has regained pre-war levels. But supplies available per person are below pre-war, since population increased about 10 per cent in the war and post-war period. For the world as a whole the supply per person would probably reach pre-war levels in some six or seven years. In the Far East and Latin America it would take longer.

Some of the best-fed nations of the pre-war period have become better fed; some of the worst, worse fed. Before the war about one-fifth of the population of the world had a daily diet of 2,000 calories or less. The number now on this inadequate diet has increased to about one-third of the world's population.

At the other end of the scale, three of the four countries outside Europe with a pre-war daily diet of more than 3,000 calories have increased both calorie and protein intake.

About two-fifths of the world's food exports are from Canada and the United States, an increase in 10 years from less than one-seventh of the total. The United States' share in world exports of bread grains rose from about one-tenth before the war to close to one-half since the war.

While the world is relying more heavily on dollar covntries for both agricultural and industrial goods, the means of paying for them have decreased. Even present inadequate consumption levels of food-deficit countries are precariously held. Their gold and dollar reserves have been lowered. Loans and gifts on an unprecedented scale have been extended by Canada and the United States.

Any sudden fall in dollar earnings of the food-deficit countries or in volume of United States' gifts and loans might bring about a food shortage in those countries and a surplus disposal problem in North America. Two requirements have to be met to effect a more balanced world agricultural economy. Efficient production in the soft-currency and underdeveloped areas must be expanded. And the high level of agricultural production and large volume of agricultural exports of North America must be maintained.

The Conference declared that the expanded programme of technical assistance, 'more than any other programme of international aid, can transform the lives of hundreds of millions of disadvantaged people.' A resolution was passed accepting the programme as previously approved by the Economic and Social Council and the General Assembly of the United Nations.—Reproduced from *FAO Bulletin*, Jan.-Feb, 1950.

CORRIGENDUM

February, 1950 issue of *Indian Farming*, page 60, line 33 *for* 5,000 *read* 500.

COVER ILLUSTRATION

PLUMERIA

—By Yalawati.